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# RESEARCH MEMORANDUM

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PERFORMANCE OF BASIC XJ79-GE-1 TURBOJET ENGINE  
AND ITS COMPONENTS

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NATIONAL ADVISORY COMMITTEE  
FOR AERONAUTICS

WASHINGTON

May 8, 1958

(Second printing, for non-military distribution, May 31, 1961)



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NACA RM E58C12

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RESEARCH MEMORANDUM

## PERFORMANCE OF BASIC XJ79-GE-1 TURBOJET ENGINE AND ITS COMPONENTS

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## SUMMARY

An investigation to determine the performance of the XJ79-GE-1 turbojet engine and its components, while operating as integral parts of the engine, was conducted in an altitude test chamber at the NACA Lewis laboratory. Data were obtained over a range of Reynolds number indices from 0.60 to 0.08 and for various settings of the variable compressor stators and variable-area exhaust nozzle from fully open to fully closed positions.

4709  
Compressor performance and turbine performance are presented in the form of performance maps at selected values of Reynolds number index; the effects of Reynolds number on performance are summarized. The effects of variable stator angle and high inlet-air temperatures on compressor performance are also shown. Combustor performance is given in generalized form as a function of the usual combustor parameters. Exhaust system data are presented to permit the calculation of over-all engine performance from pumping characteristics. Maps of engine pumping characteristics are presented at selected values of Reynolds number index, and the general effect of Reynolds number on the pumping characteristics is summarized. Over-all engine performance (net thrust and specific fuel consumption) is presented for a flight Mach number of 0.9 at rated engine conditions over a range of altitudes to illustrate performance losses resulting from decreased Reynolds number index. All component and engine performance data are presented in tabular as well as graphical form.

## INTRODUCTION

An investigation to determine the performance of the XJ79-GE-1 turbojet engine and its components while operating as integral parts of the engine was conducted over a range of Reynolds number indices in an altitude test chamber at the NACA Lewis laboratory. This engine incorporates variable inlet-guide vanes and variable stator vanes in the first six compressor stages as a means of avoiding part-speed surge. The engine also has an afterburner and iris-type variable primary and secondary

exhaust nozzles; however, during the investigation reported herein, the afterburner was inoperative and the secondary nozzle was removed. The variable-stator system and the variable exhaust nozzle are normally scheduled automatically by a combination electronic and hydraulic control, but they were manually positioned during this investigation.

The performance data were obtained over a range of Reynolds number indices from 0.60 to 0.08 with the variable stators in the open position and over a range of stator positions from  $0^{\circ}$  to  $35^{\circ}$  at a Reynolds number index of 0.20. At each Reynolds number index and stator position, data were obtained over a range of engine speeds at five exhaust-nozzle areas. Data were obtained at engine inlet temperatures up to  $700^{\circ}$  R, but the bulk of the data was obtained at an inlet temperature of approximately  $416^{\circ}$  R.

Component performance data are presented over a range of Reynolds number indices and variable stator positions. Generalized engine data are presented in a form that permits computation of engine performance at operating conditions other than those specifically investigated, and the method of such computation is illustrated. All component and engine performance data obtained during this investigation are presented in tabular as well as graphical form.

#### APPARATUS

##### Engine

The XJ79-GE-1 turbojet engine has a length of 207 inches and a maximum diameter of 32.6 inches at the turbine section. The frontal area based on the compressor tip diameter is 4.89 square feet. The dry weight of the engine and its accessories is about 3150 pounds. The manufacturer's static sea-level military performance rating (nonafterburning) is 9600 pounds of thrust with a specific fuel consumption of 0.87 pound per hour per pound of thrust at an engine speed of 7460 rpm and a turbine-outlet temperature of  $1070^{\circ}$  F.

The XJ79-GE-1 turbojet engine has several minor airflow bleeds that are used for cabin pressurization, anti-icing, turbine cooling, and bearing-seal pressurization. These bleed flows are extracted from the main engine airflow at the seventh and ninth compressor stages and at the seventeenth compressor-stage seal. The amount of bleed flows dumped overboard during this investigation did not exceed approximately 1.5 percent of the inlet airflow; the remainder of the bleed flows reentered the main stream before reaching the afterburner diffuser section.

### Engine Components

Compressor. - The seventeen-stage axial-flow compressor has variable inlet guide vanes and variable stator blades in the first six stages that are moved simultaneously from the open position to their respective closed positions. The angle of travel from open to closed for the various stages is as follows: inlet guide vanes,  $47^\circ$ ; first stator stage,  $44^\circ$ ; second through fifth stages,  $35^\circ$ ; and sixth stage,  $41^\circ$ . All references to stator position throughout the report will be in terms of the second through fifth stages as a matter of convenience; that is, the closed position will be referred to as  $35^\circ$ . The compressor has a constant tip diameter of 29.95 inches through the first fourteen stages and tapers down to a tip diameter of 29.3 inches at the seventeenth stage. The hub-tip radius ratios of the first, fourteenth, and seventeenth stages are 0.36, 0.86, and 0.88, respectively. The compressor was designed to deliver an airflow of 162 pounds per second and a total-pressure ratio of 12.2 at static sea-level military conditions.

Combustor. - The combustor is a cannular type with ten circular through-flow inner liners. Fuel is supplied to each liner through a single-inlet duplex fuel nozzle. Ignition is provided by a spark plug in one of the inner liners and spreads to the other liners through interconnecting crossfire tubes. The combustor-inlet reference velocity, based on the full burner section area of 4.33 square feet, is approximately 89 feet per second at design sea-level conditions.

Turbine. - The three-stage impulse-type turbine has a constant pitch-line diameter on all three stages and tip diameters of 28.4, 29.65, and 31.05 inches for the first, second, and third stages, respectively. The hub-tip radius ratios of the first, second, and third stages are 0.81, 0.70, and 0.59, respectively. The increase in annular area through the turbine occurs entirely in the turbine nozzles. The turbine was designed to operate at a turbine-inlet temperature of  $1700^\circ F$  at 7460 rpm. Damping rods are installed between adjacent third-stage rotor blades to reduce blade vibration. These rods are  $3/16$  inch in diameter and are situated at approximately 75 percent of the blade height.

Control and exhaust system. - The engine control schedules the variable-stator assembly to vary continuously as a function of corrected engine speed from the closed position ( $35^\circ$ ) at 64 percent of rated corrected speed to the open position ( $0^\circ$ ) at 90 percent of rated corrected speed (fig. 1). During the investigation, the original schedule was altered as shown by the dashed line of figure 1 to achieve a higher thrust during operation at a high engine-inlet temperature corresponding to a flight Mach number of 2.0. The primary exhaust nozzle, which is a convergent, variable-area iris-type nozzle, is scheduled to vary in gradual steps from an open position at idle conditions to a closed

position at military position of the power lever. During this investigation, however, the variable-stator assembly and the exhaust nozzle were manually controlled. The afterburner, which was inoperative during this investigation, has a maximum internal diameter of about 34 inches and includes a diffuser, fuel-injection bars, a pilot burner, a three-ring gutter-type flameholder, and a corrugated and louvered cooling liner. The variable secondary exhaust nozzle was removed during this investigation.

### Installation

A view of the XJ79-GE-1 turbojet engine installed in the altitude test chamber is shown in figure 2. The engine was rigidly mounted on a flexure-plate supported test platform that was connected by a linkage to a calibrated null-type thrust cell. Dry refrigerated or heated air entered the engine inlet through a bellmouth Venturi duct, which was mounted to the engine inlet and test platform. The inlet section is separated from the exhaust section by the front bulkhead, which incorporates a labyrinth seal around the inlet Venturi duct to prevent the flow of combustion air directly into the exhaust section and to permit the measurement of thrust forces. The inlet- and exhaust-pressure controls are designed to maintain automatically a constant ram-pressure ratio and exhaust pressure.

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### Instrumentation

Instrumentation for measuring pressures and temperatures was installed at various stations through the engine as shown in figure 3. The table presented on the figure indicates the number and type of measurements at each station. Total-pressure and temperature probes at each station were located at the approximate centers of equal annular-area increments so that measurements could be averaged arithmetically. Instrumentation was also provided to measure the portion of bleed flows dumped overboard through the compressor-discharge standpipes.

Pressures were measured by null-type diaphragm capsules and recorded by a digital, automatic multiple-pressure recorder. Temperatures were measured and recorded by iron-constantan and Chromel-Alumel thermocouples in conjunction with self-balancing potentiometers. Fuel flow was measured by a calibrated turbine-type flowmeter. The variable stator position and primary exhaust-nozzle area were determined from cold calibrations of output voltages from linear potentiometers in their actuating mechanisms.

## PROCEDURE

Most of the data were obtained at the minimum inlet-air temperature consistently available (approximately 416° R) to extend the range of corrected engine speeds. Engine-inlet pressures were selected in conjunction with this inlet temperature to give a Reynolds number index range from 0.60 to 0.08. Some data were obtained at higher inlet-air temperatures up to 700° R at a constant Reynolds number index of 0.4 in order to investigate the effect of temperature itself on the reproducibility of the data.

With the variable stators in the open position, data were obtained at each Reynolds number index at five fixed settings of the variable-area exhaust nozzle over an engine speed range from military (7460 rpm) down to the surge region. At a Reynolds number index of 0.2, similar data were obtained for other settings of the variable stators down to the fully closed position. Fuel conforming to the specification MIL-F-5624A grade JP-4 with a lower heating value of 18,700 Btu per pound and a hydrogen-carbon ratio of 0.171 was used throughout the investigation. Definitions of symbols, methods of calculation, and a sample calculation of engine performance from generalized performance data are presented in appendixes A, B, and C, respectively.

## RESULTS AND DISCUSSION

## Component Performance

Compressor performance and turbine performance are presented in the form of performance maps at selected values of Reynolds number index, and the effects of Reynolds number on performance are summarized. The effects of variable stator angle and hot inlet-air temperatures on compressor performance are also shown. Combustor performance is presented in a generalized form as a function of the usual combustor parameters. Exhaust-system data are also shown to permit the calculation of over-all engine performance.

Compressor performance. - The compressor performance map at a Reynolds number index of 0.60 with the variable stators in the open position is shown in figure 4(a). At design compressor pressure ratio (12.2) and rated corrected engine speed (7460 rpm), the corrected airflow was approximately 159 pounds per second, and the compressor efficiency was 0.784. Compressor efficiency reached a maximum of 0.80 to 0.81 at a corrected engine speed of approximately 6900 rpm. At a given corrected engine speed, variation in compressor pressure ratio (as limited by operation of the compressor and turbine as engine components) caused variations in compressor efficiency only of the order of 0.01. The corrected airflow was unaffected by compressor-pressure-ratio variations at

high corrected engine speeds; but at a corrected speed of 6600 rpm, the corrected airflow was lowered about 3 percent by increasing pressure ratio over the range permitted by the variable-area exhaust nozzle.

The open-stator compressor performance map at a Reynolds number index of 0.20 is shown in figure 4(b). At the design pressure ratio and rated corrected engine speed, corrected airflow was about 2 percent lower and compressor efficiency was approximately 0.02 lower than at a Reynolds number index of 0.60. Peak compressor efficiency was approximately 0.03 lower and occurred at a slightly higher corrected speed. Variations in pressure ratio at a given corrected speed had a greater effect on corrected airflow at this lower Reynolds number index (0.20). At a corrected speed of 6600 rpm, increasing the compressor pressure ratio over the permissible range lowered the corrected airflow about 6.5 percent at a Reynolds number index of 0.2 compared with a 3 percent reduction at a Reynolds number index of 0.6.

The compressor performance at a Reynolds number index of 0.20 with the variable stators fully closed is shown in figure 4(c). The variable stators are scheduled to be closed only for the low-speed portion of the map. The compressor performance was mapped over the full range of corrected engine speed and exhaust-nozzle area at this stator position (fully closed) to permit the determination of compressor performance for other possible schedules of engine speed with stator position and other exhaust-nozzle area schedules. With the stators closed, the compressor operates in a region of considerably reduced airflow and pressure ratio and the peak compressor efficiency is less than 0.60. Corrected airflow was sensitive to compressor pressure ratio over the entire corrected engine speed range. The slope of the corrected speed line at 5200 rpm illustrates the advisability of scheduling a large exhaust-nozzle area at this operating condition.

Compressor efficiency and corrected airflow for open stator operation are shown in figure 5 as functions of Reynolds number index for constant values of corrected engine speed and compressor pressure ratio. Reynolds number variations had no appreciable effect on compressor efficiency or corrected airflow for values of Reynolds number index greater than approximately 0.4. At a corrected engine speed of 8000 rpm and a pressure ratio of 12.50, reducing the Reynolds number index from 0.4 to 0.08 lowered the compressor efficiency by 0.05 and lowered the corrected airflow approximately 7 percent. The decrease in efficiency and corrected airflow with decreasing Reynolds number index was greater at the lower corrected engine speeds. Compressor performance losses due to Reynolds number effects were also greater at higher compressor pressure ratios, especially in the low corrected-engine-speed region.

4709

Corrected airflow data obtained over a range of inlet-air temperatures corresponding to flight Mach numbers up to 2.0 did not appear to generalize within the expected accuracy of the airflow measurements (fig. 6(a)). The apparent trend of increasing corrected airflow with increased inlet temperature was still doubtful because the compressor pressure ratio was not quite constant in spite of the constant exhaust-nozzle area, and the hot-temperature data were in the low corrected-engine-speed region where pressure ratio was shown to have an effect (see fig. 5). However, after the effects of compressor pressure ratio were eliminated (fig. 6(b)), the trend of increasing corrected airflow still existed and amounted to approximately a 3 percent increase in corrected airflow for an increase in inlet temperature from  $416^{\circ}$  to  $700^{\circ}$  R. Although the reasons for this effect are not understood, it is believed that the accuracy of the data involved establishes the existence of this trend.

The effect of stator position on compressor performance is shown in figure 7 for a range of exhaust-nozzle areas at a Reynolds number index of 0.20. Corrected airflow with the variable stators closed was approximately 38 percent of the open stator value at a corrected engine speed of 8000 rpm and about 44 percent of the open stator value at a corrected engine speed of 6700 rpm (fig. 7(a)). The corrected engine speeds at each stator position that correspond to the control schedule values (fig. 1) are shown on the figure by vertical dashes. The corrected airflow for off-schedule operation or for altered schedules may be approximated by linear interpolation.

Compressor pressure ratio (fig. 7(b)) with the variable stators closed was about 36 percent of the open stator value at a corrected engine speed of 8000 rpm and about 42 percent of the open stator value at 6700 rpm. At the corrected speed of 6700 rpm, the closed nozzle pressure ratio of 9.1 could be reduced to 8.3 by opening the exhaust nozzle or to 3.85 by closing the stator vanes. The low-speed stall-line intercept with open stators and an exhaust-nozzle area of 2.81 square feet and the approximate scheduled operating line of the variable stators are indicated on figure 7(b) to illustrate the necessity of an antistall device on this high-compression-ratio compressor.

The effect of stator position on compressor efficiency is shown in figure 7(c). Peak compressor efficiency was lowered from 0.77 to 0.75 by closing the variable stators from  $0^{\circ}$  to  $18^{\circ}$ , but dropped off rapidly to less than 0.60 when the stators were fully closed to  $35^{\circ}$ . The corrected engine speed at which the engine is scheduled to operate for a given stator position was in the region of peak compressor efficiency for the two closed-stator positions investigated.

Combustor performance. - The variation of combustion efficiency with the combustion parameter  $w_{a,2}T_9$  is shown in figure 8. This parameter is approximately proportional to the combustor-inlet parameter  $PT/V$  and is more convenient in conjunction with over-all engine performance calculations. Combustion efficiency varied from 0.97 at the highest values of  $w_{a,2}T_9$  to 0.90 at a combustion parameter of approximately 15,000, which essentially covered the range of engine and flight conditions investigated with the variable stators in the open position. With the stators closed at a Reynolds number index of 0.20, the combustion parameter could be reduced further, and the combustion efficiency dropped off rapidly with decreasing engine speed and increasing exhaust-nozzle area to about 0.33 at a combustion parameter  $w_{a,2}T_9$  of 4500. However, this condition would not normally be encountered in actual flight and is presented as isolated combustor performance beyond the usual range of a combustor operating as an integral part of the engine. The combustor-inlet conditions of pressure, temperature, and reference velocity at this point were approximately 750 pounds per square foot absolute,  $610^{\circ}$  R, and 60 to 70 feet per second, respectively. The corresponding inlet conditions for the maximum combustion parameter and combustion efficiency were 13,626 pounds per square foot absolute,  $1078^{\circ}$  R, and 82 feet per second, respectively.

The combustor total-pressure loss ratio as a function of combustor temperature ratio is shown in figure 9. As the temperature ratio increased from 1.45 to 2.05, the combustor total-pressure loss ratio decreased from 0.07 to 0.05. This reduction in total-pressure loss ratio results from the more rapid decrease in friction pressure loss that accompanies the decrease in combustor-inlet Mach number in comparison with the increasing momentum pressure loss as combustor temperature ratio is increased.

Turbine performance. - The over-all performance of the turbine is presented in terms of corrected turbine enthalpy drop and turbine gas-flow parameter for lines of constant corrected turbine speed, pressure ratio, and efficiency. The turbine performance map determined from open stator data at a compressor-inlet Reynolds number index of 0.60 is shown in figure 10(a). The range of engine speeds and exhaust-nozzle areas investigated caused the turbine-inlet Reynolds number index to vary from 1.04 to 1.41, but, as will be shown later, Reynolds number has little or no effect on turbine performance in this range. Over the narrow range of corrected turbine speed and pressure ratio as limited by operating in an engine at a constant stator position, the turbine efficiency varied from 0.86 to 0.88. The corrected turbine gas flow, which can be obtained by factoring out the corrected turbine speed and the factor 60 from the turbine gas-flow parameter, was about 28.3 pounds per second.

At a compressor-inlet Reynolds number index of 0.20 and open stator position, the Reynolds number index at the turbine inlet varied from 0.29 to 0.43 (fig. 10(b)). The turbine performance map was quite similar to that at the higher Reynolds number index; the corrected turbine gas flow was still about 28.3 pounds per second; the turbine efficiency varied from 0.86 to 0.88. However, the peak turbine efficiency of 0.88 occurred over a smaller range of the performance map than at the higher Reynolds number index.

4709  
Turbine performance at the lowest turbine-inlet Reynolds number indices investigated (0.13 to 0.19) is shown in figure 10(c). The much larger range of this turbine performance map resulted from the combination of closed-stator data at a compressor-inlet Reynolds number index of 0.2 (lower right portion of map) and open-stator data at a compressor-inlet Reynolds number index of 0.08 (top left portion of map). The turbine efficiency lines must be considered only approximate because of the relatively large Reynolds number index variation for this low Reynolds number index range; but it is evident that the peak efficiency shifted to a region of lower corrected work and pressure ratio than at the higher Reynolds number indices. The minimum turbine efficiency encountered during the investigation was about 0.82 and occurred during closed-stator operation at a Reynolds number index of 0.20. The trend of the constant corrected speed lines to lower corrected gas flows at the low turbine pressure ratios indicates that the turbine nozzles were unchoked when operating with the variable stators in the closed position. When the turbine nozzles were choked, the corrected turbine gas flow was still about 28.3 pounds per second, the same as at the higher turbine Reynolds number indices.

The effect of Reynolds number on turbine performance is summarized in figure 11. At the conditions where Reynolds number effect could be isolated, that is, at constant values of corrected turbine speed and pressure ratio, the turbine efficiency was not affected by Reynolds number down to a Reynolds number index of about 0.4, but dropped off about 0.02 as the Reynolds number index was reduced to 0.15. There was no apparent Reynolds number effect on corrected turbine gas flow over the range of Reynolds number indices investigated.

Exhaust system. - The exhaust-system data are presented to allow calculation of over-all engine performance from pumping characteristics which are based on turbine-outlet pressure. Tailpipe total-pressure loss data are shown in figure 12 as a function of the turbine gas-flow parameter  $w_{g,5}\sqrt{T_9/P_5}$ , which is a function of the turbine-outlet Mach number.

With the variable stators in the open position, the tailpipe total-pressure loss increased from 4.5 percent of the turbine-outlet total pressure at a gas-flow parameter of 1.02 up to about 13 percent at 1.47. At the static sea-level military condition, the gas-flow parameter is 1.26 and the total-pressure loss ratio is about 0.07. The turbine

gas-flow parameter could be lowered to 0.65 with the stators fully closed, at which point the total-pressure loss ratio was about 0.04. Data obtained with the largest exhaust-nozzle area resulted in total-pressure loss ratios as high as 0.35 (not shown on figure), indicating that choked flow existed somewhere near the turbine instead of at the exhaust-nozzle throat. The exhaust nozzle became unchoked at turbine gas-flow parameters somewhere between 1.47 and 1.53.

The velocity coefficient of the primary exhaust nozzle with the secondary nozzle removed is shown in figure 13 as a function of nozzle pressure ratio. When the exhaust nozzle was unchoked (nozzle pressure ratio  $p_0/P_9 > 0.5$ ), data scatter made the values unreliable. When the exhaust nozzle was choked, however, the data fell about a mean value of about 0.985.

#### Engine Performance

Several aspects of the over-all engine performance are discussed in this section. Typical effects of variable stator position on net thrust and specific fuel consumption are presented at a specific flight condition and exhaust-nozzle area. Engine pumping characteristics with open stators are presented at selected values of Reynolds number index and the general effect of Reynolds number on the pumping characteristics is summarized. Net thrust and specific fuel consumption are presented for a flight Mach number of 0.9 at rated engine conditions over a range of altitudes above the tropopause to illustrate over-all performance losses resulting from decreased Reynolds number index.

Some typical effects of variable stator position on over-all engine performance are shown in figure 14 for one specific flight condition and exhaust-nozzle area. Net thrust fell off rapidly in approximately linear fashion when the stators were closed. This is, of course, the expected trend on the basis of the corresponding airflow and compressor pressure ratio reductions (figs. 7(a) and (b)). Although the thrust dropped rapidly, the specific fuel consumption increased only slightly with closure of the stators to about the mid position ( $180^\circ$ ). However, the specific fuel consumption increased rapidly as the stators were closed further. This nonlinear variation of specific fuel consumption with stator position is a result of the similar variation in compressor efficiency with stator position shown in figure 7(c). Inasmuch as the variable stators are generally scheduled to be open except for certain engine transient operations at reduced speeds, the following presentation of generalized steady-state engine performance is confined to the open stator position.

4709 Pumping characteristic maps, which consist of the variation of engine pressure ratio with corrected engine speed with lines of constant engine temperature ratio and corrected airflow, are shown in figure 15 for Reynolds number indices of 0.6, 0.2, 0.12, and 0.08. The peaks of the lines of constant engine temperature ratio show the regions of maximum combined compressor and turbine efficiencies. The slope of the lines of constant corrected airflow at low corrected engine speeds reflects the reduction in corrected airflow with increasing pressure ratio as discussed in the compressor performance section. Over-all engine performance may be determined for choked exhaust-nozzle operation at any flight condition corresponding to a Reynolds number index greater than 0.08 by use of the pumping characteristic maps and several auxiliary curves (figs. 6, 8, 12, 13, 18, and 19). A sample calculation of engine performance using this method is presented in appendix C.

The general trend of engine pressure ratio and corrected airflow with Reynolds number index is shown in figure 16 for several corrected engine-speed and temperature-ratio conditions. Curves similar to these can be constructed from the pumping maps for calculating engine performance at other engine conditions and can be interpolated for intermediate values of Reynolds number index.

The reduction in net thrust and increase in specific fuel consumption resulting from Reynolds number effects on the engine components are shown in figure 17 for the rated engine speed and limiting temperature condition over a range of altitudes from about 35,400 feet (tropopause) to 72,000 feet at a flight Mach number of 0.90. This corresponds to a range of compressor-inlet Reynolds number indices from 0.46 to 0.08. Increasing the altitude over this range reduced the corrected net thrust by 14 percent, 6 percent of which was due to reduced airflow. The lower engine pressure ratio resulting from reductions in the compressor and turbine efficiencies accounted for about 6 percent of the thrust loss, and about 2 percent was due to the increased tailpipe pressure loss brought about by the above effects on the turbine-outlet Mach number. The specific fuel consumption was increased about 16 percent as altitude was increased over this range, 6 percent of which can be charged to combustion efficiency, 8 percent to the compressor and turbine efficiencies, and 2 percent to the higher tailpipe pressure loss.

#### SUMMARY OF RESULTS

The results of performance tests on the XJ79-GE-1 turbojet engine and its components are summarized as follows:

1. At rated corrected engine speed (7460 rpm) and design compressor pressure ratio, the corrected airflow was 159 pounds per second and the compressor efficiency was 0.784 at a Reynolds number index of 0.6. At

this Reynolds number index, peak compressor efficiency was between 0.80 and 0.81 and occurred at a corrected engine speed of approximately 6900 rpm. Compressor performance was not appreciably affected by Reynolds number at Reynolds number index values greater than approximately 0.4. Lowering the Reynolds number index from 0.4 to 0.08 reduced the compressor efficiency 0.05 and lowered the corrected airflow approximately 7 percent at the highest corrected speed (8000 rpm) at which comparisons could be made. Increasing the engine inlet temperature from  $416^{\circ}$  to  $700^{\circ}$  R at a constant Reynolds number index resulted in approximately a 3 percent higher corrected airflow for a given corrected engine speed and compressor pressure ratio.

2. Varying the variable stators from the open to closed position ( $0^{\circ}$  to  $35^{\circ}$ ), resulted in reductions in corrected airflow and compressor pressure ratio on the order of 60 percent. Peak compressor efficiency was lowered only 0.02 by closing the stators halfway, but decreased rapidly when the stators were closed further. Net thrust fell off rapidly when the stators were closed, but the specific fuel consumption remained relatively low until the stators were closed more than halfway. The planned schedule of variable stator position as a function of corrected engine speed apparently safely bypassed the low-speed stall region and passed through the regions of peak compressor efficiency.

3. Combustion efficiency varied from 0.97 to 0.90 over the range of engine and flight conditions investigated with the variable stators in the open position. The combustor total-pressure loss ratio varied from 0.05 to 0.07 over the range of combustor temperature ratios investigated.

4. Turbine efficiency varied only from 0.88 to 0.86 for open-stator operation throughout the investigation. The minimum turbine efficiency encountered was about 0.82 and occurred during closed-stator operation at a Reynolds number index of 0.20. Turbine efficiency was not affected by Reynolds number down to a turbine-inlet Reynolds number index of about 0.4, but dropped off about 0.02 as the turbine-inlet Reynolds number index was reduced to about 0.15. There was no apparent Reynolds number effect on corrected turbine gas flow over the range of Reynolds number indices investigated.

5. An increase in altitude from the tropopause to 72,000 feet at a flight Mach number of 0.9 (Reynolds number index reduction from 0.46 to 0.08) resulted in a 14 percent reduction in net thrust and an increase in specific fuel consumption of 16 percent in comparison with the values that would be obtained assuming no losses in component performance with increasing altitude.

## APPENDIX A

## SYMBOLS

The following symbols are used in this report:

|   |  |
|---|--|
| A | area, sq ft  |
| B | balance force from thrust capsule, lb  |
| C | coefficient  |
| F | thrust, lb   |
| g | acceleration due to gravity, $32.17 \text{ ft/sec}^2$  |
| H | enthalpy, Btu/lb   |
| M | Mach number  |
| N | engine speed, rpm  |
| P | total pressure, lb/sq ft abs   |
| p | static pressure, lb/sq ft abs  |
| R | gas constant, ft-lb/(lb)(°R)   |
| T | total temperature, °R  |
| t | static temperature, °R   |
| V | velocity, ft/sec   |
| w | flow rate, lb/sec or lb/hr   |
| β | γ correction factor, $\frac{1.4}{\gamma} \frac{\left(\frac{\gamma+1}{2}\right)^{\frac{\gamma}{\gamma-1}}}{\left(\frac{1.4+1}{2}\right)^{\frac{1.4}{1.4-1}}}$ |
| γ | ratio of specific heats  |
| δ | ratio of total pressure to NACA standard sea-level static pressure   |

$\delta/\Phi \sqrt{\theta}$  Reynolds number index

$\eta$  efficiency

$\theta$  ratio of total temperature to NACA standard sea-level static temperature

$\Phi$  ratio of absolute viscosity to viscosity of NACA standard atmosphere at sea level

Subscripts:

a air

B combustor

b bleed

C compressor

cr critical

eff effective

f fuel

g gas

id ideal

j jet

n net

s slip joint in inlet duct

T turbine

v velocity

0 free-stream conditions

1 inlet Venturi throat

2 compressor inlet

3 compressor outlet, combustor inlet

4709

- 4        combustor outlet, turbine inlet
- 5        turbine outlet
- 5a      turbine outlet (GE control thermocouples)
- 9        exhaust-nozzle inlet

## APPENDIX B

## METHODS OF CALCULATION

Airflow. - Airflow was determined from measurements of total-pressure upstream of the bellmouth, static pressure in the inlet Venturi throat, and temperature at the compressor inlet. These measurements were used to calculate engine-inlet airflow from the equation,

$$w_a = pA \sqrt{\frac{2\gamma g}{(\gamma - 1)RT} \left( \frac{P}{p} \right)^{\frac{\gamma-1}{\gamma}} \left[ \left( \frac{P}{p} \right)^{\frac{\gamma}{\gamma-1}} - 1 \right]}$$
4709

Overboard leakage airflow was calculated similarly from pressure and temperature measurements in the compressor discharge standpipes and was subtracted from the inlet airflow for all stations downstream of the point of extraction. Tailpipe gas flow was obtained from the expression

$$w_{g,5} = w_{a,1} - w_{a,b} + w_f / 3600$$

Compressor efficiency. - The compressor efficiency is defined as the ratio of isentropic enthalpy rise to the actual enthalpy rise across the compressor

$$\eta_C = \frac{(H_{a,3})_{\text{isentropic}} - H_{a,2}}{H_{a,3} - H_{a,2}}$$

The enthalpy values were determined from charts based on the material of reference 1 using variable specific heats.

Combustion efficiency. - The combustion efficiency is defined as the ratio of the ideal fuel-air ratio necessary to obtain the engine temperature rise to the actual fuel-air ratio:

$$\eta_B = \frac{(w_f/w_{a,5})_{\text{id}}}{(w_f/w_{a,5})_{\text{actual}}}$$

The ideal fuel-air ratio was determined from the fuel properties and the engine temperature rise (see fig. 18 or ref. 2).

<sup>3/3</sup> Turbine efficiency. - The turbine efficiency is defined as the ratio of actual enthalpy drop to isentropic enthalpy drop across the turbine:

$$\eta_T = \frac{H_{g,4} - H_{g,5}}{(H_{g,4} - H_{g,5})_{\text{isentropic}}}$$

The turbine-inlet temperature  $T_4$  was calculated by assuming that the turbine enthalpy drop equaled the compressor enthalpy rise. The enthalpy values were then determined from charts based on the material of reference 1 using variable specific heats.

Jet thrust (measured). - Jet thrust was determined from the thrust-measuring system by an algebraic summation of the forces acting on the engine:

$$F_j = B + A_s(P_1 - p_0)$$

where  $B$  is the balance force from the hydraulic capsule. The last term represents the momentum and pressure forces on the installation at the labyrinth seal.

Jet thrust (calculated). - Jet thrust was also calculated from the gas flow and effective jet velocity:

$$F_j = \frac{w_{g,5}}{g} V_{\text{eff}}$$

The effective velocity, which includes the effect of excess pressure not converted to velocity for supercritical pressure ratios, was obtained from the effective velocity parameter of reference 3 (also see fig. 19). The ratio of measured thrust to calculated thrust is the velocity coefficient  $C_V$ , which can be used for all choked nozzle conditions to obtain true jet thrust when multiplied by the calculated jet thrust.

Net thrust. - Net thrust was determined by subtracting the inlet momentum from the jet thrust:

$$F_n = F_j - \frac{w_{a,2}}{g} V_0$$

## APPENDIX C

## SAMPLE CALCULATION OF ENGINE PERFORMANCE

## FROM GENERALIZED PERFORMANCE DATA

In order to illustrate the method for obtaining over-all engine performance from generalized performance data, a numerical example is presented for the following flight and engine conditions:

|   |        |
|---|--------|
| Altitude, ft . . . . .                              | 35,400 |
| Flight Mach number, $M_0$ . . . . .                 | 0.9    |
| Engine speed, $N$ , rpm . . . . .                   | 7460   |
| Exhaust-gas total temperature, $T_9$ , °R . . . . . | 1530   |

From these conditions the following quantities are known:

$$p_0 = 490 \text{ lb/sq ft abs}$$

$$t_0 = 392.4^\circ \text{ R}$$

From these quantities, and assuming 100 percent ram-pressure recovery and an NACA standard day, the following parameters may be calculated:

$$V_0 = 874 \text{ ft/sec}$$

$$P_2 = 829 \text{ lb/sq ft abs}$$

$$T_2 = 456^\circ \text{ R}$$

$$\sqrt{\theta_2} = 0.9373$$

$$\delta_2 = 0.3918$$

$$\delta_2/\phi_2\sqrt{\theta_2} = 0.46$$

$$N/\sqrt{\theta_2} = 7959 \text{ rpm}$$

$$T_9/T_2 = 3.355$$

From figure 15, values of engine pressure ratio and corrected airflow can be obtained at a corrected engine speed of 7959 rpm and an engine temperature ratio of 3.355 for various values of Reynolds number index. Curves similar to those in figure 16 can be constructed and the engine pressure ratio and corrected airflow at a Reynolds number index

of 0.46 can be obtained:

$$P_5/P_2 = 2.633$$

$$w_{a,2}\sqrt{\theta_2/\delta_2} = 165.75 \text{ lb/sec}$$

and

$$P_5 = 2183 \text{ lb/sq ft abs}$$

$$w_{a,2} = 69.29 \text{ lb/sec}$$

The overboard bleed flow is about 1.5 percent of the inlet airflow, and the airflow downstream of the turbine is

$$w_{a,5} = 68.25 \text{ lb/sec}$$

To determine combustion efficiency, the combustion parameter  $w_{a,2}T_9$  is calculated,

$$w_{a,2}T_9 = 106.0 \times 10^3$$

and from figure 8,

$$\eta_B = 0.968$$

From the engine temperature rise, the ideal fuel-air ratio may be determined from figure 18

$$T_9 - T_2 = 1074^\circ \text{ R}$$

$$(w_f/3600 w_{a,5})_{id} = 0.0148$$

Dividing by combustion efficiency to obtain actual fuel-air ratio yields

$$w_f/3600 w_{a,5} = 0.01529$$

and

$$w_f = 1.044 \text{ lb/sec or } 3757 \text{ lb/hr}$$

To obtain the exhaust-nozzle total pressure, it is necessary to determine the tailpipe pressure loss, which is shown in figure 12 as a

function of  $w_{g,5}\sqrt{T_9/P_5}$ ,

$$\begin{aligned} w_{g,5} &= w_{a,5} + w_f/3600 \\ &= 68.25 + 1.04 \\ &= 69.29 \text{ lb/sec} \end{aligned}$$

$$w_{g,5}\sqrt{T_9/P_5} = 1.242$$

$$(P_5 - P_g)/P_5 = 0.0665$$

and

$$P_g = (1 - 0.0665)P_5 = 2038 \text{ lb/sq ft abs}$$

The exhaust-nozzle pressure ratio is

$$P_0/P_g = 0.2404$$

From figure 13, the exhaust-nozzle velocity coefficient is

$$C_V = 0.985$$

To calculate thrust, the effective velocity must be determined. From the fuel-air ratio and exhaust-gas temperature, the ratio of specific heats is

$$\gamma_9 = 1.337$$

From figure 19, the effective velocity parameter is

$$V_{\text{eff}}/\sqrt{gRT_9} = 1.513$$

The effective velocity then becomes

$$V_{\text{eff}} = 2452 \text{ ft/sec}$$

and the jet thrust is

$$F_j = \frac{w_{g,5}}{g} C_V V_{\text{eff}} = 5201 \text{ lb}$$

By subtracting the inlet momentum, the net thrust becomes

$$F_n = F_j - \frac{w_{a,2}}{g} V_0 = 3319 \text{ lb}$$

and the specific fuel consumption is

$$w_f/F_n = 1.132 \text{ lb/(hr)(lb thrust)}$$

#### REFERENCES

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3. Turner, L. Richard, Addie, Albert N., and Zimmerman, Richard H.: Charts for the Analysis of One-Dimensional Steady Compressible Flow. NACA TN 1419, 1948.

TABLE I. - PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Reading | Reynolds number index, $\frac{R_2}{\rho_2^2 \sqrt{\delta_2}}$ | Variable stator position, deg | Engine speed, rpm | Exhaust nozzle area, $A_e$ , sq ft | Compressor inlet total temperature, $T_{2e}$ , °R | Compressor outlet total temperature, $T_{2s}$ , °R | Turbine inlet total temperature, $T_{4e}$ , °R | Turbine outlet total temperature, $T_{4s}$ , °R | Exhaust gas total temperature, $T_g$ , °R | Compressor outlet total pressure, $P_{2e}$ , lb/sq ft abs | Turbine inlet total pressure, $P_{4e}$ , lb/sq ft abs | Turbine outlet total pressure, $P_{4s}$ , lb/sq ft abs | Exhaust nozzle inlet total pressure, $P_{9e}$ , lb/sq ft abs | Tank static pressure, $P_0$ , lb/sq ft abs | Engine inlet air flow, $w_{a,2}$ , lb/sec | Overboard bleed air flow, $w_{a,b}$ , lb/sec | Tail-pipe gas flow, $w_{g,2}$ , lb/sec | Fuel flow, $w_f$ , lb/hr | Jet thrust, $F_j$ , lb | Net thrust, $F_n$ , lb |      |
|---------|---|-------------------------------|-------------------|------------------------------------|---|--|--|---|---|---|---|--|--|--|---|--|--|--------------------------|------------------------|------------------------|------|
| 1       | 0.802   | 0                             | 7458              | 2.556                              | 418   | 1078   | 2114   | 1856  | 1857                                      | 987   | 13,626  | 12,927   | 2718   | 2650                                       | 743                                       | 64.90  | .91                                    | 54.98                    | 4625                   | 8105                   | 4845 |
| 2       | .806  | 0                             | 7462              | 2.612                              | 417   | 1078   | 2088   | 1405  | 1496                                      | 981   | 14,508  | 12,817   | 2654   | 2483                                       | 745                                       | 65.10  | .89                                    | 55.25                    | 4680                   | 8940                   | 4376 |
| 3       | .805  | 0                             | 7457              | 2.956                              | 417   | 1071   | 1951   | 1380  | 1288                                      | 959   | 15,117  | 12,419   | 2887   | 2075                                       | 744                                       | 64.92  | .91                                    | 54.65                    | 4080                   | 5210                   | 3747 |
| 4       | .802  | 0                             | 7458              | 4.690                              | 418   | 1081   | 1916   | 1228  | 1228                                      | 958   | 12,864  | 11,923   | 1854   | 1237                                       | 739                                       | 64.80  | .86                                    | 54.53                    | 5380                   | 3618                   | 2048 |
| 5       | .803  | 0                             | 7272              | 2.621                              | 418   | 1048   | 1986   | 1426  | 1422                                      | 980   | 15,074  | 12,586   | 2889   | 2356                                       | 739                                       | 64.93  | .92                                    | 54.58                    | 4250                   | 5658                   | 4079 |
| 6       | .801  | 0                             | 7288              | 2.958                              | 419   | 1041   | 1888   | 1280  | 1297                                      | 969   | 12,754  | 12,056   | 2232   | 2010                                       | 748                                       | 64.18  | .91                                    | 54.06                    | 5890                   | 5069                   | 3593 |
| 7       | .803  | 0                             | 7285              | 4.701                              | 416   | 1052   | 1733   | 1135  | 1163                                      | 963   | 12,263  | 11,560   | 1794   | 1200                                       | 757                                       | 64.31  | .88                                    | 55.94                    | 5105                   | 3409                   | 1852 |
| 8       | .597  | 0                             | 7274              | 4.714                              | 419   | 1022   | 1753   | 1130  | 1162                                      | 963   | 12,243  | 11,511   | 1785   | 1192                                       | 735                                       | 65.43  | .89                                    | 53.23                    | 3060                   | 3387                   | 1844 |
| 9       | .804  | 0                             | 7082              | 2.339                              | 418   | 1026   | 2061   | 1512  | 1512                                      | 958   | 15,129  | 12,465   | 2882   | 2719                                       | 741                                       | 65.18  | .88                                    | 55.36                    | 4650                   | 6072                   | 4544 |
| 10      | .800  | 0                             | 7080              | 2.359                              | 419   | 1030   | 2048   | 1520  | 1499                                      | 958   | 15,082  | 12,450   | 2812   | 2663                                       | 740                                       | 65.27  | .82                                    | 55.58                    | 4550                   | 9002                   | 4485 |
| 11      | .608  | 0                             | 7083              | 2.508                              | 417   | 1080   | 1905   | 1365  | 1357                                      | 964   | 18,704  | 12,058   | 2455   | 2286                                       | 742                                       | 64.82  | .90                                    | 64.18                    | 5920                   | 5817                   | 4044 |
| 12      | .612  | 0                             | 7085              | 2.938                              | 412   | 1006   | 1774   | 1220  | 1226                                      | 986   | 12,530  | 11,829   | 2124   | 1914                                       | 749                                       | 64.06  | .95                                    | 55.84                    | 3580                   | 4903                   | 3284 |
| 13      | .612  | 0                             | 7086              | 4.586                              | 414   | 1001   | 1687   | 1080  | 1104                                      | 961   | 11,851  | 11,255   | 1746   | 1601                                       | 746                                       | 65.86  | .94                                    | 62.65                    | 2850                   | 3296                   | 1750 |
| 14      | .615  | 0                             | 6710              | 2.197                              | 410   | 977  | 2001   | 1805  | 1805                                      | 983   | 12,720  | 12,071   | 2845   | 2371                                       | 739                                       | 61.83  | .88                                    | 61.76                    | 4496                   | 5985                   | 4474 |
| 15      | .609  | 0                             | 6713              | 2.348                              | 414   | 975  | 1879   | 1380  | 1568                                      | 986   | 12,177  | 11,627   | 2609   | 2473                                       | 744                                       | 60.96  | .92                                    | 60.89                    | 3846                   | 8410                   | 5954 |
| 16      | .607  | 0                             | 6712              | 2.613                              | 415   | 968  | 1745   | 1845  | 1858                                      | 987   | 11,787  | 11,118   | 2286   | 2113                                       | 749                                       | 61.15  | .69                                    | 60.91                    | 3290                   | 4841                   | 5377 |
| 17      | .605  | 0                             | 6707              | 2.936                              | 416   | 980  | 1634   | 1118  | 1125                                      | 987   | 11,418  | 10,757   | 1659   | 1779                                       | 722                                       | 60.82  | .87                                    | 60.49                    | 2900                   | 4350                   | 2788 |
| 18      | .600  | 0                             | 6529              | 2.127                              | 417   | 958  | 1863   | 1410  | 1589                                      | 981   | 10,589  | 10,503   | 2570   | 2482                                       | 742                                       | 75.09  | .92                                    | 72.94                    | 3558                   | 4887                   | 3887 |
| 19      | .604  | 0                             | 6526              | 2.548                              | 417   | 927  | 1739   | 1820  | 1885                                      | 987   | 10,679  | 10,104   | 2305   | 2187                                       | 760                                       | 73.82  | .95                                    | 75.39                    | 3106                   | 4906                   | 5177 |
| 20      | .603  | 0                             | 6529              | 2.811                              | 417   | 918  | 1611   | 1140  | 1137                                      | 986   | 10,425  | 9,924  | 2019   | 1892                                       | 721                                       | 74.54  | .87                                    | 74.19                    | 2850                   | 4141                   | 2888 |
| 21      | .593  | 0                             | 6521              | 2.157                              | 406   | 915  | 1808   | 1080  | 1030                                      | 975   | 10,106  | 9,513  | 1776   | 1687                                       | 741                                       | 76.84  | .88                                    | 76.55                    | 2275                   | 3786                   | 3512 |
| 22      | .584  | 0                             | 6523              | 4.896                              | 418   | 906  | 1890   | 989   | 919                                       | 989   | 9,548   | 8,925  | 1575   | 1618                                       | 753                                       | 78.47  | .90                                    | 72.83                    | 1800                   | 3662                   | 564  |
| 23      | .586  | 0                             | 5964              | 2.138                              | 416   | 878  | 1880   | 1085  | 1354                                      | 988   | 9,023   | 8,324  | 2157   | 2048                                       | 744                                       | 63.59  | .83                                    | 63.29                    | 2605                   | 3719                   | 2543 |
| 24      | .604  | 0                             | 5967              | 2.348                              | 416   | 871  | 1875   | 1143  | 1135                                      | 988   | 8,765   | 8,259  | 1789   | 1747                                       | 741                                       | 63.71  | .83                                    | 63.52                    | 2278                   | 3362                   | 2908 |
| 25      | .607  | 0                             | 5969              | 2.618                              | 416   | 884  | 1482   | 1020  | 1026                                      | 980   | 8,575   | 8,067  | 1876   | 1575                                       | 753                                       | 64.72  | .83                                    | 64.28                    | 1980                   | 2998                   | 1854 |
| 26      | .808  | 0                             | 5960              | 2.938                              | 416   | 889  | 1271   | 980   | 986                                       | 988   | 8,584   | 7,968  | 1470   | 1581                                       | 740                                       | 65.35  | .79                                    | 64.61                    | 1875                   | 2843                   | 1423 |
| 27      | .602  | 0                             | 5960              | 4.696                              | 417   | 880  | 1868   | 795   | 896                                       | 980   | 7,984   | 7,343  | 1158   | 929  | 750                                       | 64.02  | .88                                    | 63.33                    | 1890                   | 1448                   | 296  |
| 28      | .407  | 0                             | 7457              | 2.592                              | 416   | 1077   | 2102   | 1850  | 1811                                      | 943   | 9,082   | 8,802  | 1778   | 1681                                       | 448                                       | 66.77  | .62                                    | 66.88                    | 3280                   | 4155                   | 2918 |
| 29      | .404  | 0                             | 7460              | 2.618                              | 416   | 1074   | 2093   | 1828  | 1803                                      | 959   | 8,970   | 8,498  | 1745   | 1627                                       | 447                                       | 54.84  | .86                                    | 54.85                    | 5350                   | 4934                   | 2970 |
| 30      | .406  | 0                             | 7456              | 2.788                              | 416   | 1072   | 2013   | 1440  | 1480                                      | 943   | 8,854   | 8,368  | 1612   | 1485                                       | 449                                       | 56.85  | .89                                    | 56.88                    | 2895                   | 3461                   | 2830 |
| 31      | .402  | 0                             | 7458              | 2.958                              | 416   | 1068   | 1570   | 1384  | 1384                                      | 936   | 8,659   | 8,180  | 1510   | 1369                                       | 448                                       | 56.89  | .83                                    | 56.25                    | 2720                   | 3757                   | 2550 |
| 32      | .409  | 0                             | 7457              | 4.733                              | 415   | 1080   | 1818   | 1220  | 1226                                      | 944   | 8,485   | 7,983  | 1245   | 828  | 454                                       | 57.10  | .87                                    | 57.00                    | 2820                   | 3698                   | 1378 |
| 33      | .411  | 0                             | 6711              | 2.175                              | 417   | 984  | 2013   | 1880  | 1882                                      | 982   | 8,495   | 8,063  | 1869   | 1866                                       | 448                                       | 54.88  | .87                                    | 54.87                    | 5040                   | 4085                   | 2676 |
| 34      | .386  | 0                             | 6712              | 2.344                              | 416   | 977  | 1806   | 1480  | 1583                                      | 989   | 8,104   | 7,698  | 1747   | 1857                                       | 442                                       | 53.17  | .83                                    | 53.11                    | 2644                   | 3784                   | 2663 |
| 35      | .403  | 0                             | 6712              | 2.618                              | 416   | 948  | 1782   | 1270  | 1257                                      | 937   | 7,624   | 7,372  | 1813   | 1412                                       | 449                                       | 53.83  | .83                                    | 53.68                    | 2270                   | 3358                   | 2204 |
| 36      | .407  | 0                             | 6706              | 2.928                              | 416   | 968  | 1842   | 1135  | 1134                                      | 943   | 7,682   | 7,199  | 1313   | 1194                                       | 448                                       | 53.57  | .80                                    | 53.65                    | 1940                   | 3008                   | 1864 |
| 37      | .403  | 0                             | 6715              | 4.730                              | 416   | 954  | 1865   | 1015  | 958                                       | 987   | 6,884   | 6,587  | 1070   | 729  | 454                                       | 54.01  | .83                                    | 53.67                    | 1800                   | 1987                   | 626  |
| 38      | .403  | 0                             | 7519              | 2.585                              | 495   | 1141   | 1779   | 1390  | 1689                                      | 901   | 9,082   | 1700   | 1584   | 448  | 62.45                                     | .89  | 62.58                                  | 2800                     | 4290                   | 2374                   |      |
| 39      | .403  | 0                             | 7665              | 2.968                              | 497   | 1101   | 1965   | 1295  | 1295                                      | 907   | 8,920   | 8,598  | 1587   | 1436                                       | 450                                       | 58.46  | .89                                    | 58.25                    | 3375                   | 3887                   | 2034 |
| 40      | .404  | 0                             | 7000              | 2.885                              | 497   | 1101   | 1965   | 1295  | 1295                                      | 907   | 8,930   | 8,598  | 1587   | 1436                                       | 450                                       | 58.46  | .89                                    | 58.25                    | 3375                   | 3887                   | 2034 |

TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Specific<br>fuel<br>consumption,<br>$\frac{W_f}{F_n}$ ,<br>lb<br>(hr)(lb thrust) | Engine<br>total-<br>temperature<br>ratio,<br>$T_0/T_2$ | Engine<br>total-<br>pressure<br>ratio,<br>$F_0/F_2$ | Compressor   |   |   |   | Combustor   |   |  |  | Turbine                                      |  |   |   | Tailpipe  |  | Ex. Nozzle  |  | Read-<br>ing |
|--|--|---|--|---|---|---|---|---|--|--|--|--|---|---|---|--|---|--|--------------|
|  |  |   | Com-<br>pressed<br>engine<br>airflow,<br>$\frac{W_e}{F_2}$ ,<br>lb/sec | Com-<br>pressor<br>effi-<br>ciency,<br>$\eta_C$ | Com-<br>pressor<br>pres-<br>sure<br>ratio,<br>$F_3/F_2$ | Com-<br>bus-<br>tor<br>total-<br>loss<br>ratio,<br>$F_5 - F_4$<br>$F_5$ | Com-<br>bus-<br>tor<br>affi-<br>ciency,<br>$\eta_B$ | Fuel-<br>air<br>ratio,<br>$W_F/W_{e,5}$ | Tur-<br>bine<br>effi-<br>ciency,<br>$\eta_T$ | Tur-<br>bine<br>pres-<br>sure<br>ratio,<br>$F_4/F_5$ | Tur-<br>bine<br>affi-<br>ciency,<br>$\eta_T$ | Com-<br>pressed<br>turbine<br>speed,<br>$N_T$<br>$\sqrt{F_4 \text{ or } F_5}$<br>rpm | Com-<br>pressed<br>turbine<br>enthalpy<br>drop,<br>$\Delta H_T$<br>$\frac{F_4 \text{ or } F_5}{Dtu/lb}$ | Com-<br>pressed<br>turbine<br>gas flow,<br>$W_{e,4}/\sqrt{F_4 \text{ or } F_5}$<br>lb/sec | Tailpipe<br>gas flow,<br>$W_{e,5}/\sqrt{F_5}$<br>lb/sec | Tailpipe<br>total-<br>pressure<br>loss<br>ratio,<br>$F_5 - F_9$<br>$F_5$ | Exhaust-<br>nozzle<br>pressure<br>ratio,<br>$P_0/P_9$ | Ex-<br>pansive<br>velocity<br>coeffi-<br>cient,<br>$C_v$ |              |
|  |  |   |  |   |   |   |   |   |  |  |  |  |   |   |   |  |   |  |              |
| 1.062  | 3.685  | 2.841   | 8508   | 166.28  | 16.84   | 0.710   | 0.051   | 0.958                                   | 0.0160                                       | 4.754  | 0.875  | 3792   | 41.29   | 27.77   | 1.281   | 0.062  | 0.2814  | 0.984  | 1            |
| 1.065  | 3.688  | 2.741   | 8524   | 167.95  | 14.06   | .703  | 0.051   | 0.985                                   | 0.0154                                       | 4.882  | 0.875  | 3521   | 41.83   | 27.88   | 1.266   | 0.069  | 0.3043  | 0.987  | 2            |
| 1.073  | 3.581  | 2.585   | 8519   | 167.97  | 15.68   | .699  | 0.053   | 0.975                                   | 0.0135                                       | 5.450  | 0.879  | 3284   | 44.17   | 28.14   | 1.575   | 0.064  | 0.3586  | 0.984  | 3            |
| 1.082  | 2.928  | 1.935   | 8511   | 167.47  | 15.28   | .690  | 0.059   | 0.964                                   | 0.0113                                       | 8.451  | 0.867  | 4034   | 46.91   | 27.96   | 1.591   | 0.053  | 0.5974  | 0.971  | 4            |
| 1.042  | 3.402  | 2.634   | 8103   | 167.94  | 15.69   | .729  | 0.084   | 0.971                                   | 0.0142                                       | 4.880  | 0.876  | 3762   | 61.08   | 28.34   | 1.261   | 0.068  | 0.3137  | 0.983  | 5            |
| 1.047  | 3.096  | 2.307   | 8087   | 186.03  | 15.28   | .727  | 0.085   | 0.967                                   | 0.0123                                       | 5.382  | 0.875  | 3877   | 44.12   | 28.01   | 1.356   | 0.100  | 0.5703  | 0.986  | 6            |
| 1.877  | 2.798  | 1.888   | 8115   | 187.58  | 12.87   | .716  | 0.088   | 0.961                                   | 0.0104                                       | 4.438  | 0.867  | 4020   | 46.74   | 28.01   | 1.588   | 0.351  | 0.6142  | 0.987  | 7            |
| 1.894  | 2.773  | 1.873   | 8088   | 188.59  | 12.88   | .724  | 0.080   | 0.961                                   | 0.0104                                       | 5.448  | 0.868  | 4020   | 46.80   | 27.84   | 1.580   | 0.352  | 0.6149  | 0.971  | 8            |
| 1.023  | 5.658  | 2.987   | 7810   | 186.01  | 15.75   | .751  | 0.051   | 0.961                                   | 0.0157                                       | 4.388  | 0.864  | 3810   | 38.90   | 28.18   | 1.182   | 0.080  | 0.2785  | 0.984  | 9            |
| 1.028  | 5.578  | 2.935   | 7880   | 185.83  | 15.68   | .752  | 0.050   | 0.959                                   | 0.0154                                       | 4.480  | 0.876  | 3810   | 39.69   | 28.22   | 1.148   | 0.085  | 0.2779  | 0.982  | 10           |
| .869   | 5.284  | 2.547   | 7802   | 165.70  | 15.18   | .744  | 0.063   | 0.979                                   | 0.0151                                       | 4.903  | 0.860  | 3742   | 41.99   | 28.38   | 1.283   | 0.068  | 0.3848  | 1.018  | 11           |
| 1.028  | 2.876  | 2.828   | 7898   | 188.82  | 18.90   | .757  | 0.088   | 0.978                                   | 0.0154                                       | 5.478  | 0.862  | 3878   | 44.21   | 28.15   | 1.382   | 0.089  | 0.3915  | 0.988  | 12           |
| 1.828  | 2.687  | 1.817   | 7838   | 185.07  | 18.44   | .753  | 0.088   | 0.963                                   | 0.0108                                       | 5.448  | 0.869  | 4007   | 48.63   | 27.93   | 1.580   | 0.312  | 0.6195  | 0.975  | 13           |
| 1.008  | 5.659  | 3.118   | 7880   | 186.01  | 15.55   | .768  | 0.051   | 0.970                                   | 0.0155                                       | 4.043  | 0.868  | 3453   | 37.89   | 28.32   | 1.068   | 0.042  | 0.2988  | 0.987  | 14           |
| .977   | 5.304  | 2.729   | 7817   | 180.06  | 12.74   | .780  | 0.053   | 0.970                                   | 0.0124                                       | 4.418  | 0.861  | 3571   | 39.73   | 28.93   | 1.147   | 0.082  | 0.3008  | 0.983  | 15           |
| .874   | 2.978  | 2.588   | 7506   | 180.59  | 12.58   | .778  | 0.057   | 0.970                                   | 0.0114                                       | 4.907  | 0.861  | 3700   | 41.91   | 28.16   | 1.288   | 0.068  | 0.3848  | 0.986  | 16           |
| 1.004  | 2.700  | 2.047   | 7481   | 159.88  | 11.93   | .780  | 0.058   | 0.968                                   | 0.0098                                       | 5.481  | 0.875  | 3837   | 45.85   | 27.94   | 1.377   | 0.092  | 0.4058  | 0.991  | 17           |
| .989   | 3.531  | 2.702   | 7060   | 145.78  | 11.48   | .808  | 0.051   | 0.970                                   | 0.0137                                       | 4.009  | 0.868  | 3381   | 57.01   | 28.56   | 1.068   | 0.042  | 0.3014  | 0.985  | 18           |
| .977   | 5.054  | 2.410   | 7057   | 148.08  | 11.18   | .805  | 0.054   | 0.968                                   | 0.0118                                       | 4.382  | 0.876  | 3495   | 38.21   | 28.06   | 1.132   | 0.058  | 0.3429  | 0.988  | 19           |
| .982   | 2.727  | 2.113   | 7060   | 147.89  | 10.90   | .807  | 0.058   | 0.965                                   | 0.0100                                       | 4.888  | 0.860  | 3829   | 41.58   | 28.06   | 1.239   | 0.085  | 0.3811  | 0.989  | 20           |
| .994   | 2.469  | 1.894   | 7055   | 149.64  | 10.57   | .784  | 0.059   | 0.904                                   | 0.0035                                       | 5.380  | 0.864  | 3746   | 45.37   | 28.77   | 1.376   | 0.080  | 0.4871  | 1.009  | 21           |
| 2.123  | 2.198  | 1.478   | 7057   | 148.14  | 10.20   | .801  | 0.053   | 0.943                                   | 0.0070                                       | 5.498  | 0.860  | 3900   | 45.01   | 27.65   | 1.587   | 0.281  | 0.7439  | 0.971  | 22           |
| 1.094  | 2.971  | 2.821   | 6861   | 125.84  | 9.38  | .801  | 0.055   | 0.954                                   | 0.0116                                       | 3.968  | 0.861  | 3357   | 37.78   | 28.39   | 1.041   | 0.042  | 0.3633  | 0.978  | 23           |
| 1.050  | 2.724  | 1.922   | 6854   | 126.39  | 9.10  | .803  | 0.056   | 0.947                                   | 0.0101                                       | 4.385  | 0.868  | 3453   | 38.32   | 28.14   | 1.198   | 0.050  | 0.4159  | 0.981  | 24           |
| 1.049  | 2.488  | 1.746   | 6836   | 127.71  | 8.93  | .802  | 0.059   | 0.952                                   | 0.0085                                       | 4.813  | 0.877  | 3579   | 40.82   | 28.11   | 1.228   | 0.080  | 0.4761  | 0.978  | 25           |
| 1.177  | 2.248  | 1.528   | 6857   | 188.65  | 8.72  | .801  | 0.064   | 0.953                                   | 0.0079                                       | 5.341  | 0.860  | 3498   | 48.91   | 28.13   | 1.348   | 0.081  | 0.5477  | 0.983  | 26           |
| 4.399  | 1.981  | 1.915   | 6849   | 127.18  | 6.28  | .800  | 0.069   | 0.952                                   | 0.0067                                       | 5.341  | 0.861  | 3285   | 46.25   | 28.26   | 1.572   | 0.198  | 0.5075  | 0.988  | 27           |
| 1.107  | 3.852  | 2.765   | 8329   | 167.25  | 14.13   | .708  | 0.053   | 0.945                                   | 0.0160                                       | 4.838  | 0.876  | 3758   | 41.75   | 28.19   | 1.245   | 0.068  | 0.2897  | 0.994  | 28           |
| 1.098  | 3.615  | 2.751   | 8329   | 167.68  | 14.04   | .701  | 0.055   | 0.953                                   | 0.0157                                       | 4.870  | 0.876  | 3764   | 41.61   | 28.35   | 1.258   | 0.068  | 0.2747  | 0.981  | 29           |
| 1.101  | 3.415  | 2.611   | 8328   | 167.78  | 13.78   | .698  | 0.055   | 0.962                                   | 0.0143                                       | 5.191  | 0.869  | 3833   | 45.44   | 28.35   | 1.330   | 0.080  | 0.3028  | 0.986  | 30           |
| 1.067  | 3.278  | 2.574   | 8330   | 167.85  | 15.41   | .697  | 0.055   | 0.961                                   | 0.0134                                       | 5.417  | 0.864  | 3586   | 44.36   | 28.50   | 1.378   | 0.093  | 0.3278  | 1.017  | 31           |
| 1.888  | 3.262  | 2.923   | 8339   | 167.74  | 12.17   | .800  | 0.058   | 0.959                                   | 0.0144                                       | 5.419  | 0.868  | 4020   | 48.95   | 28.28   | 1.508   | 0.337  | 0.5498  | 0.981  | 32           |
| 1.047  | 3.587  | 3.020   | 7487   | 169.67  | 13.08   | .783  | 0.051   | 0.957                                   | 0.0134                                       | 4.028  | 0.867  | 3450   | 37.73   | 28.37   | 1.078   | 0.049  | 0.2378  | 0.987  | 33           |
| 1.082  | 3.348  | 2.688   | 7487   | 168.40  | 13.31   | .804  | 0.058   | 0.947                                   | 0.0140                                       | 4.380  | 0.875  | 3546   | 59.34   | 28.15   | 1.125   | 0.068  | 0.2486  | 0.990  | 34           |
| 1.030  | 3.022  | 2.375   | 7487   | 160.11  | 12.26   | .781  | 0.055   | 0.955                                   | 0.0119                                       | 4.872  | 0.876  | 3676   | 41.84   | 28.39   | 1.268   | 0.067  | 0.3180  | 0.983  | 35           |
| 1.057  | 2.726  | 2.042   | 7492   | 168.70  | 11.92   | .761  | 0.060   | 0.947                                   | 0.0101                                       | 5.483  | 0.875  | 3611   | 45.80   | 27.83   | 1.376   | 0.081  | 0.3756  | 0.988  | 36           |
| 1.858  | 2.440  | 1.677   | 7500   | 160.58  | 11.93   | .774  | 0.053   | 0.958                                   | 0.0084                                       | 6.445  | 0.861  | 3952   | 45.85   | 28.08   | 1.588   | 0.324  | 0.8271  | 0.988  | 37           |
| 1.179  | 2.088  | 2.182   | 7494   | 161.12  | 12.04   | .776  | 0.057   | 0.957                                   | 0.0106                                       | 5.342  | 0.874  | 3786   | 45.88   | 28.38   | 1.387   | 0.088  | 0.2754  | 0.983  | 38           |
| 1.173  | 2.088  | 2.088   | 7183   | 168.58  | 11.07   | .798  | 0.061   | 0.970                                   | 0.0115                                       | 5.305  | 0.872  | 3747   | 45.46   | 28.83   | 1.385   | 0.088  | 0.2782  | 0.988  | 39           |
| 2.614  | 1.342  | 1.783   | 7183   | 168.58  | 11.07   | .798  | 0.061   | 0.971                                   | 0.0115                                       | 5.305  | 0.872  | 3747   | 45.46   | 28.83   | 1.385   | 0.088  | 0.2782  | 0.988  | 40           |

TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Read-ing | Reyn-olds number index, $\frac{r_2}{2\sqrt{\theta_2}}$ | Vari-able stator position, deg | Engine speed, N, rpm | Exhaust-nozzle area, A, sq ft | Compressor-inlet total temperature, $T_2$ , °R | Compressor-outlet total temperature, $T_4$ , °R | Turbine-inlet total temperature, $T_3$ , °R | Turbine-outlet total temperature, $T_5$ , °R | Exhaust-gas total pressure, $P_g$ (lb/sq ft abs) | Compressor-inlet total temperature, $T_2$ , °R | Compressor-outlet total pressure, $P_4$ , lb/sq ft abs | Turbine-inlet total pressure, $P_3$ , lb/sq ft abs | Turbine-outlet total pressure, $P_5$ , lb/sq ft abs | Exhaust-nozzle-inlet total pressure, $P_g$ , lb/sq ft abs | Fuel static pressure, $P_f$ , lb/sq ft abs | Engine inlet air-flow, $V_{a,b}$ , lb/sec | Overall bleed-air-flow, $V_{a,b}$ , lb/sec | Tail-pipe gas flow, $V_g$ , lb/sec | Fuel flow, $V_f$ , lb/hr | Jet thrust, $F_j$ , lb | Net thrust, $F_n$ , lb |
|----------|--|--------------------------------|----------------------|-------------------------------|--|---|---|--|--|--|--|--|---|---|--|---|--|------------------------------------|--------------------------|------------------------|------------------------|
| 41       | 0.397  | 0                              | 6817                 | 2.896                         | 497  | 1073  | 1770  | 1220   | 1255   | 793  | 8,120  | 7821   | 1420  | 1285  | 430  | 95.26                                     | 0.64                                       | 55.04                              | 2053                     | 5372                   | 1690                   |
| 42       | .568   |                                | 6824                 | 3.178                         | 532  | 1097  | 1714  | 1185   | 803  | 7,296  | 8311   | 1186   | 1049  | 439   | 48.60                                      | .58                                       | 49.36                                      | 1675                               | 2678                     | 1108                   |                        |
| 43       | .472   |                                | 6824                 | 3.178                         | 528  | 1064  | 1604  | 1080   | 1088   | 1016   | 8,228  | 7686   | 1331  | 1179  | 431  | 58.59                                     | .63  | 57.55                              | 1690                     | 5161                   | 1059                   |
| 44       | .405   |                                | 6827                 | 2.893                         | 497  | 1018  | 1804  | 1090   | 1112   | 806  | 5,895  | 8284   | 1189  | 1072  | 434  | 47.79                                     | .59  | 47.47                              | 1465                     | 2564                   | 1103                   |
| 45       | .371   |                                | 6828                 | 3.178                         | 528  | 1058  | 1528  | 1018   | 1040   | 1229   | 8,188  | 8548   | 1473  | 1303  | 425  | 67.24                                     | .68  | 66.84                              | 1715                     | 5687                   | 1002                   |
| 46       | .571   |                                | 6828                 | 3.178                         | 584  | 1017  | 1478  | 970  | 1004   | 1295   | 8,585  | 7824   | 1587  | 1908  | 428  | 65.16                                     | .68  | 62.70                              | 1460                     | 3521                   | 817                    |
| 47       | .572   |                                | 6828                 | 3.178                         | 582  | 1000  | 1451  | 945  | 972  | 1218   | 7,992  | 7441   | 1278  | 1151  | 425  | 60.19                                     | .68  | 59.72                              | 1530                     | 3044                   | 680                    |
| 48       | .588   |                                | 6806                 | 2.898                         | 499  | 970   | 1486  | 995  | 1018   | 800  | 5,385  | 5006   | 946   | 868   | 431  | 59.80                                     | .058                                       | 58.51                              | 1037                     | 1820                   | 597                    |
| 49       | .400   |                                | 7481                 | 2.890                         | 597  | 1271  | 2096  | 1455   | 1471   | 1015   | 10,385   | 9742   | 1822  | 1685  | 431  | 64.71                                     | .058                                       | 64.81                              | 2930                     | 4598                   | 2189                   |
| 50       | .404   |                                | 7456                 | 3.155                         | 595  | 1282  | 2024  | 1595   | 1410   | 1019   | 10,513   | 9842   | 1705  | 1608  | 429  | 65.39                                     | .64  | 65.30                              | 2700                     | 4444                   | 1900                   |
| 51       | .597   |                                | 7454                 | 3.178                         | 605  | 1275  | 2025  | 1400   | 1410   | 1022   | 10,055   | 9364   | 1844  | 1450  | 431  | 62.80                                     | .62  | 62.71                              | 2600                     | 4284                   | 1805                   |
| 52       | .599   |                                | 7402                 | 2.810                         | 603  | 1254  | 1863  | 1380   | 1382   | 1020   | 9,156  | 8648   | 1592  | 1453  | 422  | 58.40                                     | .51  | 58.38                              | 2355                     | 5978                   | 1689                   |
| 53       | .402   |                                | 7198                 | 3.178                         | 595  | 1210  | 1888  | 1300   | 1314   | 1015   | 8,120  | 8500   | 1491  | 1515  | 432  | 58.45                                     | .61  | 58.26                              | 2170                     | 5758                   | 1426                   |
| 54       | .400   |                                | 7050                 | 2.910                         | 595  | 1205  | 1882  | 1300   | 1320   | 1017   | 8,417  | 7877   | 1453  | 1354  | 428  | 54.89                                     | .053                                       | 54.76                              | 2020                     | 5892                   | 1381                   |
| 55       | .398   |                                | 7050                 | 3.178                         | 603  | 1200  | 1860  | 1240   | 1262   | 1020   | 8,293  | 7715   | 1354  | 1184  | 427  | 55.20                                     | .58  | 54.93                              | 1840                     | 3290                   | 1122                   |
| 56       | .408   |                                | 6880                 | 3.181                         | 587  | 1177  | 1786  | 1190   | 1209   | 1084   | 7,775  | 7241   | 1885  | 1118  | 428  | 52.55                                     | .56  | 52.22                              | 11620                    | 2968                   | 914                    |
| 57       | .403   |                                | 6704                 | 2.680                         | 597  | 1156  | 1744  | 1180   | 1222   | 1021   | 7,170  | 6898   | 1282  | 1144  | 424  | 48.84                                     | .51  | 48.41                              | 11960                    | 2656                   | 969                    |
| 58       | .399   |                                | 6760                 | 3.184                         | 602  | 1163  | 1899  | 1150   | 1172   | 1081   | 7,143  | 6848   | 1166  | 1068  | 424  | 49.21                                     | .60  | 48.95                              | 1410                     | 2639                   | 700                    |
| 59       | .392   |                                | 7600                 | 3.170                         | 703  | 1216  | 1860  | 1480   | 1485   | 1218   | 10,058   | 9861   | 1650  | 1352  | 428  | 61.48                                     | .53  | 61.47                              | 2610                     | 4279                   | 1422                   |
| 60       | .398   |                                | 7483                 | 2.905                         | 692  | 1363  | 2186  | 1638   | 1588   | 1212   | 10,256   | 9580   | 1804  | 1648  | 438  | 62.04                                     | .46  | 62.18                              | 2880                     | 4546                   | 1762                   |
| 61       | .396   |                                | 7486                 | 3.157                         | 703  | 1282  | 2048  | 1608   | 1608   | 1264   | 8,583  | 8924   | 1574  | 1369  | 429  | 59.09                                     | .57  | 58.89                              | 2980                     | 5976                   | 1866                   |
| 62       | .400   |                                | 7599                 | 3.157                         | 690  | 1256  | 2082  | 1580   | 1415   | 1224   | 9,298  | 8828   | 1927  | 1347  | 426  | 58.41                                     | .58  | 58.29                              | 2145                     | 5819                   | 1148                   |
| 63       | .398   |                                | 7501                 | 3.187                         | 696  | 1340  | 1979  | 1558   | 1380   | 1220   | 8,801  | 8164   | 1445  | 1272  | 428  | 56.07                                     | .055                                       | 55.89                              | 1890                     | 3637                   | 975                    |
| 64       | .397   |                                | 7283                 | 3.157                         | 697  | 1333  | 1860  | 1355   | 1384   | 1221   | 8,614  | 8018   | 1411  | 1243  | 430  | 54.72                                     | .052                                       | 54.57                              | 1878                     | 3401                   | 902                    |
| 65       | .397   |                                | 7196                 | 3.188                         | 697  | 1328  | 1928  | 1315   | 1342   | 1219   | 8,323  | 7749   | 1585  | 1203  | 435  | 55.48                                     | .53  | 55.28                              | 1770                     | 3289                   | 884                    |
| 66       | .203   |                                | 7463                 | 2.857                         | 422  | 1091  | 8122  | 1545   | 1585   | 587  | 4,485  | 4847   | 872   | 811   | 218  | 28.27                                     | .31  | 28.53                              | 1600                     | 2070                   | 1385                   |
| 67       | .202   |                                | 7460                 | 2.936                         | 422  | 1065  | 8198  | 1598   | 585  | 4,387  | 4184   | 785  | 995   | 215   | 28.08                                      | .26                                       | 28.05                                      | 1480                               | 1881                     | 1220                   |                        |
| 68       | .202   |                                | 7464                 | 4.889                         | 422  | 1078  | 1847  | 1245   | 1248   | 588  | 4,235  | 3983   | 926   | 414   | 217  | 28.27                                     | .26  | 28.28                              | 1183                     | 1548                   | 890                    |
| 69       | .203   |                                | 7289                 | 2.875                         | 419  | 1083  | 2061  | 1535   | 1504   | 584  | 4,387  | 4188   | 898   | 215   | 217  | 28.11                                     | .50  | 28.17                              | 1572                     | 9051                   | 1382                   |
| 70       | .187   |                                | 7275                 | 2.816                         | 421  | 1085  | 2062  | 1610   | 1483   | 516  | 4,279  | 4031   | 842   | 785   | 215  | 27.26                                     | .53  | 27.27                              | 1502                     | 1952                   | 1350                   |
| 71       | .196   |                                | 7270                 | 2.936                         | 425  | 1058  | 1918  | 1360   | 1358   | 520  | 4,177  | 3839   | 730   | 662   | 214  | 27.38                                     | .53  | 27.31                              | 1280                     | 1759                   | 1127                   |
| 72       | .198   |                                | 7272                 | 4.973                         | 425  | 1048  | 1774  | 1195   | 1194   | 580  | 4,055  | 3806   | 698   | 384   | 214  | 27.62                                     | .26  | 27.58                              | 2073                     | 1255                   | 816                    |
| 73       | .205   |                                | 7079                 | 2.477                         | 417  | 1036  | 2054  | 1538   | 1501   | 585  | 4,388  | 4158   | 914   | 861   | 214  | 27.84                                     | .13  | 27.87                              | 1853                     | 3055                   | 1405                   |
| 74       | .204   |                                | 7081                 | 2.635                         | 417  | 1051  | 1871  | 1445   | 1415   | 524  | 4,254  | 4031   | 857   | 779   | 216  | 27.92                                     | .36  | 27.87                              | 1470                     | 1911                   | 1269                   |
| 75       | .204   |                                | 7085                 | 2.963                         | 417  | 1023  | 1858  | 1300   | 1279   | 523  | 4,118  | 3844   | 782   | 658   | 214  | 27.86                                     | .32  | 27.80                              | 1221                     | 1731                   | 1045                   |
| 76       | .202   |                                | 7060                 | 4.875                         | 419  | 1017  | 1702  | 1140   | 1145   | 568  | 5,980  | 5733   | 688   | 387   | 217  | 27.71                                     | .29  | 27.62                              | 1868                     | 1169                   | 866                    |
| 77       | .199   |                                | 6711                 | 2.278                         | 421  | 1000  | 2082  | 1500   | 1502   | 519  | 4,010  | 5801   | 908   | 864   | 214  | 26.95                                     | .35  | 26.92                              | 1442                     | 1914                   | 1518                   |
| 78       | .205   |                                | 6710                 | 2.568                         | 424  | 990   | 1978  | 1480   | 1458   | 522  | 4,093  | 3878   | 889   | 655   | 215  | 26.80                                     | .34  | 26.78                              | 1450                     | 1837                   | 1317                   |
| 79       | .201   |                                | 6718                 | 4.618                         | 417  | 985   | 1868  | 1325   | 1304   | 516  | 5,304  | 3888   | 761   | 708   | 214  | 26.58                                     | .36  | 26.44                              | 1190                     | 1712                   | 1108                   |
| 80       | .199   |                                | 6712                 | 2.958                         | 418  | 978   | 1708  | 1185   | 1186   | 517  | 5,779  | 3860   | 696   | 211   | 26.48                                      | .31                                       | 26.38                                      | 1010                               | 1585                     | 814                    |                        |

TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Specific<br>fuel<br>consumption,<br>$\frac{lb}{hr}(\frac{lb}{lb \text{ thrust}})$ | Engine<br>total-<br>temperature,<br>$T_0/\sqrt{T_2}$ | Engine<br>total-<br>pressure<br>ratio,<br>$P_0/P_2$ | Compressor   |   |   |   | Combustor   |  |                             |   | Turbine                                 |   |  |   | Tailpipe  |  | Ex. Nozzle   |   | Read-<br>ing |
|---|--|---|--|---|---|---|---|--|-----------------------------|---|---|---|--|---|---|--|--|---|--------------|
|   |  |   | Cor-<br>rected<br>engine<br>speed,<br>$M_a 2 \sqrt{\theta_2}$ ,<br>rpm | Cor-<br>rected<br>airflow,<br>$M_a 2 \sqrt{\theta_2}$ ,<br>lb/sec | Com-<br>pressor<br>pres-<br>sure<br>ratio,<br>$P_3/P_2$ | Com-<br>pressor<br>effi-<br>ciency,<br>$\eta_C$ | Com-<br>bustor<br>total<br>pressure<br>loss<br>ratio,<br>$P_3 - P_4$ ,<br>$\frac{P_3}{P_4}$ | Com-<br>bustor<br>effi-<br>ciency,<br>$\eta_B$ | Fuel-air<br>ratio,<br>$w_f$ | Turbine<br>pres-<br>sure<br>ratio,<br>$P_4/P_5$ | Turbine<br>effi-<br>ciency,<br>$\eta_T$ | Cor-<br>rected<br>turbine<br>speed,<br>$N$ ,<br>rpm | Cor-<br>rected<br>turbine<br>enthalpy<br>drop,<br>$\Delta H_T$ ,<br>$\frac{Btu}{lb}$ | Cor-<br>rected<br>turbine<br>gas flow,<br>$w_{g,4} \sqrt{\theta_4}, \text{ or } P_4$ ,<br>$\frac{B_4}{F_4}$ ,<br>lb/sec | Tailpipe<br>gas flow,<br>$w_{g,5} \sqrt{\theta_5}$ ,<br>$\frac{B_5}{F_5}$ ,<br>lb/sec | Tailpipe<br>total-<br>pressure<br>loss<br>ratio,<br>$P_5 - P_9$ ,<br>$\frac{P_5}{P_9}$ | Exhaust-<br>turbine<br>pressure<br>ratio,<br>$P_9/P_0$ | Effec-<br>tive<br>veloci-<br>ty<br>coeffi-<br>cient,<br>$C_v$ |              |
|   |  |   |  |   |   |   |   |  |                             |   |   |   |  |   |   |  |  |   |              |
| 1.803   | 2.485  | 1.781   | 5965   | 144.55  | 10.24   | 0.800   | 0.062   | 0.981  | 0.0104                      | 5.547   | 0.870                                   | 3735  | 43.26  | 26.16   | 1.368   | 0.087  | 0.3318   | 0.985   | 41           |
| 1.811   | 2.287  | 1.474   | 5743   | 152.27  | 9.07  | 0.809   | 0.065   | 0.979  | 0.0095                      | 5.789   | 0.854                                   | 3769  | 43.74  | 27.79   | 1.438   | 0.114  | 0.4118   | 0.976   | 42           |
| 1.588   | 2.087  | 1.510   | 5535   | 122.74  | 8.10  | 0.784   | 0.068   | 0.942  | 0.0081                      | 5.780   | 0.858                                   | 3765  | 43.88  | 28.15   | 1.433   | 0.114  | 0.3586   | 0.983   | 43           |
| 1.526   | 2.237  | 1.450   | 5568   | 122.78  | 8.31  | 0.780   | 0.064   | 0.981  | 0.0068                      | 5.358   | 0.867                                   | 3689  | 42.87  | 28.05   | 1.354   | 0.083  | 0.4048   | 0.986   | 44           |
| 1.711   | 1.977  | 1.188   | 5590   | 116.47  | 7.49  | 0.785   | 0.072   | 0.944  | 0.0072                      | 5.803   | 0.860                                   | 3781  | 43.01  | 26.19   | 1.453   | 0.116  | 0.3282   | 0.983   | 45           |
| 1.811   | 1.915  | 1.118   | 6285   | 106.02  | 6.87  | .774  | .071  | .989   | .0068                       | 5.787   | .045                                    | 3741  | 45.84  | 26.07   | 1.454   | .115   | .3548  | .972  | 46           |
| 2.046   | 1.862  | 1.049   | 6173   | 104.79  | 6.56  | .784  | .068  | .957   | .0062                       | 5.622   | .055                                    | 3767  | 45.50  | 26.00   | 1.457   | .115   | .3740  | .971  | 47           |
| 1.757   | 2.040  | 1.183   | 6216   | 105.48  | 6.71  | .755  | .068  | .944   | .0073                       | 5.295   | .061                                    | 3638  | 41.85  | 27.89   | 1.335   | .061   | .4580  | .983  | 48           |
| 1.539   | 2.464  | 1.795   | 6960   | 144.61  | 10.21   | 0.806   | 0.060   | 0.982  | 0.0127                      | 5.347   | 0.870                                   | 3772  | 43.64  | 28.24   | 1.364   | 0.087  | .2894  | .980  | 49           |
| 1.421   | 2.370  | 1.871   | 6962   | 145.42  | 10.10   | 0.806   | 0.068   | 0.971  | 0.0116                      | 5.884   | 0.857                                   | 3684  | 44.83  | 26.31   | 1.440   | 0.116  | .3243  | .975  | 50           |
| 1.442   | 2.531  | 1.609   | 6902   | 140.42  | 8.84  | .805  | .067  | .954   | .0117                       | 5.708   | .055                                    | 3625  | 44.55  | 27.93   | 1.452   | .118   | .3972  | .987  | 51           |
| 1.599   | 2.295  | 1.561   | 5881   | 130.09  | 8.96  | .802  | .064  | .988   | .0112                       | 5.589   | .055                                    | 3749  | 43.26  | 28.15   | 1.445   | .087   | .2904  | .981  | 52           |
| 1.511   | 2.206  | 1.658   | 5792   | 132.73  | 8.99  | .019  | .068  | .954   | .0105                       | 5.701   | .057                                    | 3625  | 43.98  | 28.09   | 1.441   | .119   | .3280  | .979  | 53           |
| 1.463   | 2.204  | 1.439   | 5645   | 122.96  | 8.28  | .794  | .064  | .948   | .0104                       | 5.386   | .055                                    | 3735  | 42.30  | 27.89   | 1.350   | .088   | .3206  | .989  | 54           |
| 1.640   | 2.093  | 1.327   | 5621   | 135.43  | 8.13  | .803  | .070  | .957   | .0094                       | 5.698   | .053                                    | 3680  | 45.60  | 27.76   | 1.442   | .118   | .3576  | .980  | 55           |
| 1.772   | 2.025  | 1.255   | 6418   | 116.42  | 7.89  | .785  | .069  | .954   | .0067                       | 5.724   | .065                                    | 3780  | 44.10  | 28.01   | 1.437   | .119   | .3639  | .976  | 56           |
| 1.888   | 2.047  | 1.226   | 6254   | 108.07  | 7.02  | .774  | .056  | .947   | .0090                       | 5.348   | .061                                    | 3690  | 42.81  | 28.00   | 1.352   | .086   | .3705  | .980  | 57           |
| 2.014   | 1.917  | 1.148   | 6277   | 109.84  | 7.00  | .774  | .069  | .980   | .0081                       | 5.702   | .057                                    | 3778  | 45.57  | 28.07   | 1.437   | .120   | .4133  | .977  | 58           |
| 1.729   | 2.118  | 1.356   | 6292   | 124.33  | 8.28  | .805  | .069  | .953   | .0115                       | 5.688   | .055                                    | 3615  | 44.25  | 28.10   | 1.434   | .117   | .2920  | .978  | 59           |
| 1.832   | 2.021  | 1.406   | 6479   | 125.10  | 8.45  | .804  | .064  | .937   | .0029                       | 5.510   | .069                                    | 3696  | 45.00  | 28.25   | 1.360   | .086   | .2661  | .978  | 60           |
| 1.785   | 2.041  | 1.288   | 6410   | 118.63  | 7.81  | .814  | .067  | .944   | .0106                       | 5.870   | .054                                    | 3607  | 43.91  | 27.74   | 1.418   | .118   | .3069  | .985  | 61           |
| 1.666   | 2.056  | 1.248   | 6385   | 116.82  | 7.57  | .782  | .059  | .957   | .0103                       | 5.850   | .062                                    | 3794  | 44.27  | 28.24   | 1.436   | .118   | .3177  | .986  | 62           |
| 2.004   | 1.963  | 1.103   | 6305   | 112.81  | 7.21  | .768  | .070  | .966   | .0098                       | 5.872   | .056                                    | 3705  | 45.82  | 28.18   | 1.438   | .118   | .3365  | .987  | 63           |
| 2.079   | 1.957  | 1.188   | 6268   | 109.91  | 7.08  | .784  | .059  | .955   | .0094                       | 5.688   | .056                                    | 3776  | 43.86  | 27.95   | 1.428   | .119   | .3458  | .988  | 64           |
| 2.075   | 1.925  | 1.120   | 6228   | 107.59  | 6.83  | .761  | .049  | .957   | .0093                       | 5.877   | .057                                    | 3777  | 43.80  | 28.00   | 1.430   | .119   | .3594  | .988  | 65           |
| 1.153   | 3.609  | 2.687   | 5877   | 184.99  | 15.72   | .892  | .053  | .964   | .0160                       | 4.870   | .054                                    | 3607  | 41.95  | 28.59   | 1.258   | .070   | .2814  | .982  | 66           |
| 1.164   | 3.315  | 2.354   | 5875   | 184.48  | 15.44   | .590  | .058  | .954   | .0143                       | 5.591   | .078                                    | 3661  | 44.06  | 29.24   | 1.370   | .068   | .3085  | .987  | 67           |
| 1.714   | 2.957  | 1.920   | 5878   | 185.42  | 12.99   | .888  | .060  | .945   | .0118                       | 5.857   | .059                                    | 4004  | 46.88  | 28.50   | 1.593   | .058   | .5842  | .980  | 68           |
| 1.129   | 3.589  | 2.735   | 6090   | 184.97  | 15.57   | .710  | .052  | .953   | .0187                       | 4.704   | .077                                    | 3679  | 41.84  | 28.55   | 1.233   | .064   | .2589  | .980  | 69           |
| 1.125   | 3.523  | 2.688   | 6075   | 184.48  | 13.54   | .712  | .053  | .944   | .0158                       | 4.811   | .074                                    | 3698  | 41.84  | 28.40   | 1.247   | .066   | .2713  | .985  | 70           |
| 1.145   | 5.163  | 2.281   | 6053   | 183.36  | 13.06   | .711  | .057  | .959   | .0133                       | 5.586   | .077                                    | 3620  | 45.84  | 28.21   | 1.358   | .065   | .3233  | .985  | 71           |
| 1.745   | 2.825  | 1.863   | 6055   | 184.92  | 12.67   | .710  | .041  | .951   | .0108                       | 6.508   | .058                                    | 3678  | 46.72  | 28.29   | 1.369   | .059   | .3558  | .985  | 72           |
| 1.107   | 5.800  | 2.812   | 7897   | 182.47  | 13.44   | .730  | .053  | .949   | .0187                       | 4.937   | .064                                    | 3604  | 59.84  | 26.38   | 1.168   | .060   | .2445  | .985  | 73           |
| 1.119   | 3.393  | 2.683   | 7999   | 185.47  | 15.14   | .768  | .055  | .953   | .0144                       | 4.804   | .075                                    | 5680  | 41.45  | 28.00   | 1.255   | .069   | .2773  | .978  | 74           |
| 1.125   | 3.087  | 2.255   | 7804   | 183.65  | 12.76   | .727  | .057  | .945   | .0124                       | 5.580   | .062                                    | 3811  | 46.02  | 28.44   | 1.377   | .063   | .3387  | .979  | 75           |
| 1.781   | 2.755  | 1.614   | 7880   | 183.15  | 18.32   | .728  | .042  | .950   | .0101                       | 6.370   | .066                                    | 3951  | 46.47  | 28.28   | 1.384   | .040   | .5607  | .984  | 76           |
| 1.084   | 3.668  | 2.846   | 7451   | 184.89  | 12.87   | .762  | .062  | .949   | .0157                       | 4.188   | .064                                    | 3445  | 57.99  | 28.50   | 1.108   | .048   | .2477  | .988  | 77           |
| 1.096   | 3.522  | 2.792   | 7815   | 187.26  | 12.71   | .758  | .055  | .951   | .0181                       | 4.511   | .062                                    | 3480  | 58.01  | 28.55   | 1.137   | .051   | .2497  | .982  | 78           |
| 1.074   | 5.127  | 2.593   | 7482   | 158.55  | 12.29   | .780  | .055  | .947   | .0127                       | 4.848   | .060                                    | 3692  | 41.65  | 28.42   | 1.255   | .068   | .2773  | .978  | 79           |
| 1.105   | 2.656  | 2.076   | 7479   | 158.51  | 11.92   | .763  | .061  | .956   | .0108                       | 5.595   | .074                                    | 3743  | 45.55  | 28.40   | 1.378   | .064   | .3540  | .974  | 80           |



TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Specific<br>fuel<br>consumption,<br>$\frac{W_f}{P_n}$ ,<br>lb<br>(hr) (lb thrust) | Engine<br>total-<br>temperature<br>ratio,<br>$T_0/T_0'$ | Engine<br>total-<br>pressure<br>ratio,<br>$P_0/P_0'$ | Compressor   |  |   |   | Combustor  |  |   |                                       | Turbine                                 |  |   |   | Tailpipe  |   | Ex. Nozzle  |   | Read-<br>ing |
|---|---|--|--|--|---|---|--|--|---|---------------------------------------|---|--|---|---|---|---|---|---|--------------|
|   |   |  | Com-<br>pressed<br>engine<br>speed,<br>$\frac{N_{e,p}}{N_e}$ , | Com-<br>pressed<br>airflow,<br>$\frac{W_{e,p}}{W_e}$ , | Com-<br>pressor<br>pres-<br>sure<br>ratio,<br>$\frac{P_3}{P_2}$ , | Com-<br>pressor<br>effi-<br>ciency,<br>$\eta_c$ | Com-<br>bustor<br>total<br>pressure<br>ratio,<br>$\frac{P_4}{P_3}$ | Com-<br>bustor<br>effi-<br>ciency,<br>$\eta_b$ | Fuel-<br>air<br>ratio,<br>$\frac{W_f}{W_a}$ | Turbo-<br>nose<br>ratio,<br>$P_4/P_5$ | Turbine<br>effi-<br>ciency,<br>$\eta_t$ | Com-<br>pressed<br>turbine<br>speed,<br>$N_t$ ,<br>1/min | Com-<br>pressed<br>turbine<br>enthalpy<br>drop,<br>$\Delta H_t$ ,<br>Btu/lb | Corrected<br>turbine<br>gas flow,<br>$W_{t,p} \sqrt{\frac{P_4}{P_5}}$ ,<br>lb/sec | Tailpipe<br>gas flow<br>parameter,<br>$\frac{W_{t,p}}{P_5}$ | Tailpipe<br>total-<br>pressure<br>loss<br>ratio,<br>$\frac{P_4}{P_5}$ | Exhaust-<br>nose<br>pressure<br>ratio,<br>$P_0/P_5$ | Affect-<br>ive<br>veloci-<br>ty<br>coeffi-<br>cient,<br>$C_v$ |              |
| 0.064   | 2.515   | 1.687  | 7454   | 156.43   | 11.48   | 0.756   | 0.063  | 0.933  | 0.0091                                      | 6.575                                 | 0.866                                   | 3874   | 44.10   | 27.92   | 1.874   | 0.340   | 0.6056  | 0.960   | 61           |
| 1.193   | 2.450   | 2.578  | 7048   | 156.00   | 10.75   | 0.762   | .098   | 0.933  | 0.0181                                      | 3.944                                 | 0.854                                   | 5329   | 38.30   | 28.80   | 1.065   | .042  | 0.2885  | 0.985   | 82           |
| 1.104   | 3.157   | 2.320  | 7017   | 157.76   | 10.87   | 0.773   | .093   | 0.938  | 0.0151                                      | 4.314                                 | 0.867                                   | 5431   | 58.60   | 28.89   | 1.127   | .063  | 0.5024  | 0.986   | 83           |
| 1.192   | 2.820   | 2.019  | 7026   | 140.65   | 10.84   | 0.770   | .067   | 0.939  | 0.0110                                      | 4.987                                 | 0.872                                   | 5369   | 41.00   | 28.40   | 1.280   | .066  | 0.5453  | 0.979   | 84           |
| 1.193   | 2.581   | 1.789  | 7031   | 140.49   | 10.07   | 0.762   | .045   | 0.935  | 0.0094                                      | 5.581                                 | 0.877                                   | 5480   | 43.13   | 28.40   | 1.586   | .083  | 0.4186  | 0.976   | 85           |
| 3.194   | 2.966   | 1.413  | 5862   | 155.87   | 8.54  | .787  | .065   | .929   | .0078                                       | 6.319                                 | 0.857                                   | 3822   | 45.24   | 28.19   | 1.877   | .503  | 0.7079  | 0.945   | 86           |
| 1.167   | 5.100   | 2.084  | 6604   | 114.28   | 8.62  | .749  | .084   | .922   | 0.0350                                      | 5.960                                 | 0.866                                   | 5877   | 58.83   | 28.29   | 1.046   | .048  | 0.3839  | 0.974   | 87           |
| 1.200   | 2.846   | 1.857  | 6615   | 115.69   | 8.45  | .750  | .088   | .926   | 0.0113                                      | 4.269                                 | 0.866                                   | 5587   | 38.16   | 28.30   | 1.192   | .062  | 0.3883  | 0.976   | 88           |
| 1.291   | 2.804   | 1.830  | 6568   | 116.17   | 8.27  | .787  | .068   | .928   | .0087                                       | 4.775                                 | 0.868                                   | 5885   | 49.20   | 27.68   | 1.205   | .068  | 0.4581  | 0.983   | 89           |
| 1.159   | 2.510   | 1.430  | 6604   | 119.06   | 8.17  | .760  | .084   | .933   | .0062                                       | 5.278                                 | 0.867                                   | 5835   | 48.12   | 27.88   | 1.330   | .081  | 0.5050  | 0.974   | 90           |
| 10.250  | 2.083   | 1.178  | 6603   | 119.01   | 7.87  | .754  | .060   | .928   | .0080                                       | 6.220                                 | 0.853                                   | 3765   | 44.47   | 28.08   | 1.583   | .240  | 0.7611  | 0.956   | 91           |
| 1.142   | 3.608   | 2.688  | 6382   | 162.68   | 15.57   | .687  | .056   | .917   | 0.0180                                      | 4.834                                 | 0.860                                   | 5785   | 42.97   | 28.82   | 1.257   | .078  | 0.2797  | 0.989   | 92           |
| 1.124   | 3.456   | 2.089  | 6095   | 161.38   | 15.11   | .705  | .067   | .928   | 0.0147                                      | 4.858                                 | 0.870                                   | 5748   | 43.77   | 28.65   | 1.262   | .074  | 0.2878  | 0.978   | 93           |
| 1.108   | 3.279   | 2.475  | 7874   | 160.40   | 12.75   | .730  | .058   | .932   | 0.0158                                      | 4.840                                 | 0.877                                   | 5851   | 42.55   | 27.13   | 1.292   | .073  | 0.2905  | 0.980   | 94           |
| 1.081   | 3.017   | 2.260  | 7448   | 162.34   | 11.71   | .788  | .059   | .935   | 0.0181                                      | 4.978                                 | 0.873                                   | 5860   | 41.58   | 28.38   | 1.280   | .071  | 0.3171  | 0.984   | 95           |
| 1.105   | 2.765   | 1.986  | 7028   | 150.16   | 10.15   | .759  | .060   | .908   | .0108                                       | 4.855                                 | 0.881                                   | 3893   | 41.68   | 28.47   | 1.255   | .070  | 0.3748  | 0.982   | 96           |
| 1.235   | 2.580   | 1.854  | 6820   | 118.18   | 8.31  | .758  | .068   | .917   | .0087                                       | 4.771                                 | 0.869                                   | 3559   | 40.21   | 28.30   | 1.024   | .067  | 0.4456  | 1.001   | 97           |
| 5.044   | 2.851   | 1.526  | 5838   | 128.20   | ---   | ---   | ---  | ---  | 0.0088                                      | 5.565                                 | 0.867                                   | 4891   | 48.18   | 28.15   | 1.585   | .284  | 0.7418  | 1.003   | 98           |
| 1.228   | 3.544   | 2.008  | 6284   | 118.99   | 9.81  | .681  | .058   | .932   | 0.0158                                      | 4.208                                 | 0.875                                   | 3832   | 38.48   | 28.24   | 1.098   | ---   | ---   | ---   | 99           |
| 1.249   | 5.428   | 2.104  | 6244   | 118.94   | 9.83  | .654  | .058   | .921   | 0.0164                                      | 4.321                                 | 0.873                                   | 5867   | 39.01   | 28.28   | 1.187   | .047  | 0.3385  | 0.980   | 100          |
| 1.285   | 31108   | 1.867  | 6258   | 119.28   | 9.55  | .651  | .059   | .942   | 0.0188                                      | 4.816                                 | 0.881                                   | 4002   | 43.87   | 28.30   | 1.240   | .068  | 0.3823  | 0.981   | 101          |
| 1.398   | 2.857   | 1.811  | 6255   | 119.28   | 9.10  | .650  | .061   | .928   | 0.0113                                      | 5.505                                 | 0.876                                   | 4134   | 43.29   | 28.04   | 1.340   | .080  | 0.4837  | 0.977   | 102          |
| 3.848   | 2.489   | 1.275  | 6261   | 119.61   | 8.76  | .647  | .066   | .928   | 0.0091                                      | 4.824                                 | 0.869                                   | 4504   | 45.59   | 27.81   | 1.584   | .271  | 0.7376  | 0.965   | 103          |
| 1.906   | 3.894   | 2.051  | 6067   | 118.61   | 9.47  | .673  | .064   | .920   | 0.0143                                      | 4.303                                 | 0.877                                   | 5850   | 39.03   | 27.97   | 1.110   | .048  | 0.4408  | 0.994   | 104          |
| 1.248   | 3.248   | 2.073  | 8045   | 119.97   | 9.85  | .681  | .057   | .901   | 0.0144                                      | 4.376                                 | 0.882                                   | 3856   | 39.57   | 27.84   | 1.118   | .048  | 0.3366  | 0.984   | 105          |
| 1.274   | 2.957   | 1.808  | 8076   | 120.59   | 8.25  | .676  | .067   | .927   | 0.0120                                      | 4.817                                 | 0.881                                   | 4002   | 43.87   | 28.30   | 1.240   | .068  | 0.3823  | 0.981   | 101          |
| 1.405   | 2.479   | 1.578  | 9079   | 120.21   | 8.28  | .704  | .057   | .909   | 0.0104                                      | 5.347                                 | 0.887                                   | 4144   | 43.86   | 27.84   | 1.357   | .091  | 0.4771  | 0.976   | 107          |
| 4.068   | 2.358   | 1.885  | 8076   | 119.43   | 8.70  | .720  | .064   | .913   | 0.0065                                      | 5.484                                 | 0.858                                   | 4500   | 44.03   | 27.48   | 1.576   | .260  | 0.7554  | 0.975   | 108          |
| 1.195   | 3.481   | 2.022  | 7866   | 116.47   | 9.45  | .681  | .051   | .904   | 0.0168                                      | 5.915                                 | 0.876                                   | 3712   | 38.95   | 27.90   | 1.018   | .043  | 0.3173  | 0.987   | 109          |
| 1.213   | 3.143   | 1.991  | 7864   | 116.19   | 9.08  | .658  | .055   | .924   | 0.0133                                      | 4.301                                 | 0.883                                   | 5833   | 39.18   | 28.03   | 1.110   | .063  | 0.3850  | 0.987   | 110          |
| 1.294   | 2.825   | 1.709  | 7828   | 116.58   | 8.49  | .688  | .056   | .933   | 0.0111                                      | 4.790                                 | 0.888                                   | 5866   | 41.57   | 28.18   | 1.294   | .067  | 0.4175  | 0.971   | 111          |
| 2.176   | 2.976   | 1.184  | 7840   | 118.01   | ---   | ---   | ---  | ---  | 0.0088                                      | 5.927                                 | 0.877                                   | 5879   | 58.83   | 27.07   | 1.018   | .043  | 0.5577  | 0.991   | 113          |
| 1.210   | 3.116   | 1.975  | 7450   | 105.77   | 8.23  | .704  | .057   | .909   | 0.0111                                      | 5.837                                 | 0.864                                   | 5616   | 58.85   | 28.59   | 1.042   | .043  | 0.4165  | 0.977   | 114          |
| 1.215   | 2.851   | 1.744  | 7006   | 100.07   | 7.26  | .727  | .056   | .946   | 0.0081                                      | 4.814                                 | .849                                    | 5885   | 55.25   | 28.85   | 1.050   | .044  | 0.4686  | 0.965   | 115          |
| 1.298   | 2.611   | 1.548  | 6594   | 93.54  | 8.48  | .748  | .060   | .981   | 0.0096                                      | 5.934                                 | 0.848                                   | 5825   | 55.25   | 28.85   | 1.050   | .044  | 0.4686  | 0.965   | 115          |
| 1.558   | 2.177   | 1.169  | 5788   | 74.08  | 4.76  | .749  | .064   | .886   | 0.0073                                      | 3.712                                 | 0.841                                   | 3417   | 43.43   | 27.90   | .876  | .039  | 0.6775  | 1.002   | 116          |
| 2.075   | 2.042   | 1.106  | 5770   | 74.10  | 4.65  | .753  | .065   | .845   | 0.0088                                      | 3.927                                 | 0.842                                   | 3494   | 38.57   | 27.89   | 1.085   | .045  | 0.6885  | 0.998   | 117          |
| 5.165   | 1.917   | 1.022  | 5785   | 75.82  | 4.68  | .743  | .069   | .853   | 0.0081                                      | 4.184                                 | 0.854                                   | 5571   | 58.15   | 27.79   | 1.071   | .051  | 0.7175  | 0.995   | 118          |
| 6.688   | 1.808   | .859   | 5782   | 75.32  | 4.47  | .732  | .070   | .808   | 0.0088                                      | 4.488                                 | 0.849                                   | 5835   | 57.10   | 28.14   | 1.146   | .056  | 0.7713  | 0.981   | 119          |
| 2.067   | 3.478   | 1.296  | 9065   | 89.99  | 8.10  | .485  | .062   | .845   | 0.0178                                      | 3.751                                 | 0.860                                   | 5825   | 38.38   | 28.65   | .928  | .043  | 0.5414  | 0.986   | 120          |

TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Reading | Reynolds number, $\frac{D_2}{2\sqrt{\rho_2}}$ | Vari-<br>able<br>stator<br>posi-<br>tion,<br>deg | Engine<br>speed,<br>N,<br>rpm | Exhaust<br>nozzle<br>area,<br>A,<br>sq ft | Compressor-<br>inlet total<br>temper-<br>ature,<br>$T_2$ ,<br>°R | Compressor-<br>outlet total<br>temper-<br>ature,<br>$T_3$ ,<br>°R | turbine-<br>inlet total<br>temper-<br>ature,<br>$T_4$ ,<br>°R | turbine-<br>outlet total<br>temper-<br>ature,<br>$T_5$ ,<br>°R | Exhaust<br>gas total<br>temper-<br>ature,<br>$T_6$ ,<br>°R | Compressor-<br>inlet total<br>pressure,<br>$P_2$ ,<br>lb<br>sq ft abs | Compressor-<br>outlet total<br>pressure,<br>$P_3$ ,<br>lb<br>sq ft abs | turbine-<br>inlet total<br>pressure,<br>$P_4$ ,<br>lb<br>sq ft abs | turbine-<br>outlet total<br>pressure,<br>$P_5$ ,<br>lb<br>sq ft abs | Exhaust-<br>nozzle<br>total<br>pressure,<br>$P_6$ ,<br>lb<br>sq ft abs | Tank<br>static<br>pressure,<br>$P_0$ ,<br>lb<br>sq ft abs | Engine<br>inlet<br>air-<br>flow,<br>$W_{a,2}$ ,<br>lb/sec | Over-<br>head<br>air-<br>flow,<br>$W_{a,3}$ ,<br>lb/sec | Tail-<br>pipe<br>gas<br>flow,<br>$W_{g,5}$ ,<br>lb/sec | Fuel<br>flow,<br>$w_f$ ,<br>lb/hr | Jet<br>thrust,<br>$F_j$ ,<br>lb | Net<br>thrust,<br>$F_n$ ,<br>lb |
|---------|---|--|-------------------------------|---|--|---|---|--|--|---|--|--|---|--|---|---|---|--|-----------------------------------|---------------------------------|---------------------------------|
| 121     | 0.197   | 35   | 7026                          | 2.168                                     | 425  | 909   | 1851  | 1475   | 1413   | 518   | 1580   | 1488   | 405   | 587  | 216   | 10.05   | 0.10  | 10.06  | 350                               | 307                             | 279                             |
| 122     | .204  |  | 8716                          | 2.169                                     | 425  | 855   | 1515  | 1266   | 530  | —   | —  | 584  | 587   | 217  | 10.23   | —   | 9.76  | 407  | 371                               | 150                             |                                 |
| 123     | .200  |  | 6331                          | 2.175                                     | 425  | 905   | 1511  | 1195   | 1182   | 385   | 1522   | 1045   | 553   | 537  | 218   | 9.88  | 0   | 9.76   | 407                               | 371                             | 150                             |
| 124     | .200  |  | 5861                          | 2.175                                     | 425  | 781   | 1280  | 1065   | 1100   | 325   | 1208   | 1153   | 552   | 517  | 218   | 9.18  | .11   | 9.14   | 350                               | 311                             | 280                             |
| 125     | .201  |  | 7456                          | 2.339                                     | 417  | 947   | 1910  | 1495   | 1429   | 519   | 1695   | 1804   | 396   | 580  | 217   | 10.99   | .10   | 11.03  | 502                               | 527                             | 280                             |
| 126     | .200  |  | 7270                          | 2.339                                     | 422  | 918   | 1812  | 1418   | 1359   | 522   | 1694   | 1554   | 386   | 588  | 218   | 10.57   | .15   | 10.54  | 350                               | 446                             | 206                             |
| 127     | .200  |  | 7075                          | 2.339                                     | 423  | 991   | 1745  | 1360   | 1306   | 525   | 1541   | 1458   | 372   | 583  | 218   | 10.56   | .11   | 10.56  | 504                               | 446                             | 207                             |
| 128     | .193  |  | 8716                          | 2.339                                     | 423  | 845   | 1811  | 1240   | 1184   | 525   | 1404   | 1322   | 348   | 529  | 214   | 9.15  | .19   | 9.05   | 435                               | 376                             | 184                             |
| 129     | .202  |  | 6335                          | 2.339                                     | 418  | 787   | 1458  | 1136   | 1092   | 528   | 1287   | 1218   | 352   | 517  | 220   | 9.22  | .11   | 9.19   | 350                               | 354                             | 187                             |
| 130     | .200  |  | 5895                          | 2.346                                     | 422  | 756   | 1338  | 1050   | 1015   | 523   | 1178   | 1108   | 314   | 500  | 220   | 9.20  | 0   | 9.26   | 335                               | 288                             | 174                             |
| 131     | .198  |  | 5219                          | 2.346                                     | 425  | 684   | 1170  | 920  | 916  | 522   | 964  | 908  | 292   | 279  | 224   | 7.51  | 0   | 7.56   | 261                               | 169                             | 24                              |
| 132     | .200  |  | 4830                          | 2.346                                     | 422  | 626   | 1013  | 858  | 815  | 523   | 777  | 788  | 274   | 284  | 227   | 8.18  | .10   | 8.21   | 281                               | 122                             | 111                             |
| 133     | .200  |  | 7456                          | 2.621                                     | 422  | 946   | 1795  | 1360   | 1312   | 527   | 1627   | 1544   | 352   | 335  | 217   | 10.58   | .10   | 10.58  | 500                               | 446                             | 207                             |
| 134     | .205  |  | 7275                          | 2.621                                     | 422  | 920   | 1703  | 1280   | 1248   | 527   | 1586   | 1492   | 345   | 326  | 218   | 10.65   | .15   | 10.60  | 478                               | 421                             | 173                             |
| 135     | .201  |  | 7082                          | 2.626                                     | 422  | 883   | 1629  | 1228   | 1188   | 524   | 1807   | 1418   | 338   | 518  | 217   | 10.61   | .11   | 10.59  | 441                               | 382                             | 156                             |
| 136     | .200  |  | 8706                          | 2.621                                     | 423  | 841   | 1500  | 1180   | 1104   | 523   | 1377   | 1293   | 319   | 503  | 219   | 10.15   | .11   | 10.10  | 385                               | 331                             | 101                             |
| 137     | .197  |  | 6330                          | 2.628                                     | 425  | 900   | 1385  | 1070   | 1031   | 518   | 1282   | 1173   | 304   | 290  | 221   | 9.60  | .11   | 9.56   | 382                               | 278                             | 66                              |
| 138     | .200  |  | 6348                          | 2.628                                     | 423  | 798   | 1379  | 1060   | 1022   | 525   | 1270   | 1169   | 306   | 291  | 221   | 9.18  | .10   | 9.26   | 382                               | 275                             | 67                              |
| 139     | .198  |  | 6331                          | 2.682                                     | 423  | 754   | 1281  | 990  | 958  | 517   | 1148   | 1076   | 291   | 277  | 218   | 9.08  | .18   | 8.99   | 307                               | 287                             | 54                              |
| 140     | .198  |  | 5226                          | 2.682                                     | 422  | —   | 870   | 854  | 820  | 945   | 890  | 270  | 268   | 219  | 7.50  | 0   | 7.65  | 258  | 155                               | 13                              |                                 |
| 141     | .197  |  | 4510                          | 2.682                                     | 424  | 618   | 865   | 780  | 768  | 520   | 744  | 686  | 258   | 242  | 215   | 8.12  | .12   | 8.04   | 281                               | 98                              | 42                              |
| 142     | .199  |  | 7466                          | 2.686                                     | 421  | 752   | 1707  | 1270   | 1251   | 519   | 1497   | 1319   | 319   | 300  | 217   | 10.82   | .10   | 10.83  | 495                               | 358                             | 116                             |
| 143     | .203  |  | 7275                          | 2.688                                     | 419  | 907   | 1631  | 1200   | 1178   | 524   | 1283   | 1408   | 314   | 304  | 217   | 10.72   | .10   | 10.71  | 437                               | 342                             | 97                              |
| 144     | .202  |  | 7094                          | 2.618                                     | 417  | 881   | 1165  | 1137   | 1121   | 521   | 1483   | 1393   | 308   | 295  | 217   | 10.71   | .11   | 10.68  | 406                               | 324                             | 84                              |
| 145     | .198  |  | 6709                          | 2.910                                     | 421  | 634   | 1448  | 1078   | 1048   | 520   | 1384   | 1370   | 298   | 281  | 219   | 10.65   | .15   | 10.64  | 357                               | 277                             | 38                              |
| 146     | .197  |  | 5851                          | 2.915                                     | 423  | 752   | 1244  | 950  | 928  | 519   | 1125   | 1032   | 285   | 220  | 218   | 8.45  | .11   | 8.50   | 282                               | 197                             | 4                               |
| 147     | .198  |  | 5810                          | 2.908                                     | 424  | 680   | 1094  | 845  | 828  | 521   | 933  | 874  | 264   | 220  | 218   | 8.15  | .12   | 8.08   | 254                               | 142                             | 40                              |
| 148     | .207  |  | 4507                          | 2.963                                     | 420  | 609   | 911   | 750  | 718  | 522   | 767  | 713  | 247   | 226  | 218   | 8.21  | .12   | 8.25   | 285                               | 96                              | 53                              |
| 149     | .201  |  | 7466                          | 4.878                                     | 418  | 924   | 1532  | 1088   | 1071   | 520   | 1543   | 1445   | 285   | 215  | 218   | 11.13   | .10   | 11.11  | 388                               | 188                             | 166                             |
| 150     | .199  |  | 7287                          | 4.862                                     | 419  | 884   | 1487  | 1045   | 1035   | 518   | 1374   | 1374   | 268   | 227  | 218   | 10.64   | .11   | 10.60  | 360                               | 169                             | 171                             |
| 151     | .204  |  | 7096                          | 4.882                                     | 419  | 871   | 1458  | 1000   | 987  | 518   | 1429   | 1344   | 257   | 226  | 218   | 10.31   | .15   | 10.22  | 340                               | 171                             | 89                              |
| 152     | .202  |  | 6708                          | 4.889                                     | 423  | 628   | 1224  | 945  | 935  | 525   | 1285   | 1285   | 224   | 217  | 218   | 10.26   | .18   | 10.17  | 303                               | 144                             | 76                              |
| 153     | .204  |  | 6340                          | 4.889                                     | 417  | 778   | 1221  | 865  | 867  | 523   | 1515   | 1180   | 226   | 220  | 218   | 9.34  | .11   | 9.39   | 276                               | 128                             | 76                              |
| 154     | .204  |  | 5848                          | 4.889                                     | 418  | 738   | 1128  | 840  | 815  | 528   | 1111   | 1084   | 215   | 220  | 217   | 9.34  | .11   | 9.37   | 247                               | 100                             | 115                             |
| 155     | .202  |  | 6110                          | 4.888                                     | 420  | 998   | 1487  | 1045   | 1035   | 518   | 1424   | 1374   | 268   | 227  | 218   | 8.21  | .17   | 8.08   | 208                               | 84                              | 125                             |
| 156     | .199  |  | 4466                          | 4.898                                     | 420  | 887   | 780   | 699  | 518  | 789   | 779  | 233  | 227   | 218  | 8.89  | .10   | 8.83  | 271  | 45                                | -110                            |                                 |
| 157     | .191  |  | 7466                          | 2.820                                     | 418  | 1099  | 2112  | 1550   | 1226   | 1226  | 943  | 2470   | 463   | 447  | 140   | 16.45   | .14   | 16.56  | 960                               | 1146                            | 812                             |
| 158     | .191  |  | 7447                          | 2.958                                     | 418  | 1085  | 1457  | 1062   | 1054   | 525   | 1425   | 1425   | 423   | 423  | 140   | 16.45   | .17   | 16.49  | 904                               | 1100                            | 745                             |
| 159     | .191  |  | 7466                          | 4.679                                     | 417  | 1085  | 1511  | 1310   | 1228   | 522   | 2207   | 2207   | 376   | 428  | 143   | 16.56   | .18   | 16.58  | 788                               | 748                             | 419                             |
| 160     | .182  |  | 7261                          | 2.764                                     | 417  | 1078  | 2079  | 1489   | 1484   | 525   | 2395   | 493  | 455   | 158  | 16.61   | .17   | 16.65   | 855  | 1139                              | 781                             |                                 |

6047

TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Specific fuel consumption, $\frac{lb}{lb \text{ thrust}}$ | Engine total-temperature ratio, $T_0/T_2$ | Engine total-pressure ratio, $P_0/P_2$ | Compressor  |  |                                      |                                 | Combustor                                 |                                |                           |                           | Turbine   |   |  |   | Tailpipe  |  | Ex. Nozzle                            |       | Reading |
|---|---|--|---|--|--------------------------------------|---------------------------------|---|--------------------------------|---------------------------|---------------------------|---|---|--|---|---|--|---------------------------------------|-------|---------|
|   |   |  | Corrected engine speed, $\frac{W_{a,2}\sqrt{T_0}}{A_2}$ , rpm | Corrected engine airflow, $\frac{W_{a,2}\sqrt{T_0}}{A_2}$ , lb/sec | Compressor pressure ratio, $P_3/P_2$ | Compressor efficiency, $\eta_0$ | Combustor total pressure ratio, $P_2/P_1$ | Combustor efficiency, $\eta_B$ | Fuel-air ratio, $W_f/W_a$ | Turbine airflow, $\eta_T$ | Corrected turbine speed, $\frac{N}{\sqrt{T_0}}$ , rpm | Corrected turbine enthalpy drop, $AE_t$ | Corrected turbine gas flow, $\frac{W_{a,4}}{A_4}$ , lb/sec | Tailpipe total-pressure loss ratio, $P_5 - P_4$ | Tailpipe gas flow parameter, $\frac{W_{a,5}\sqrt{T_0}}{A_4}$ , or $\frac{P_5}{P_4}$ | Exhaust nozzle pressure ratio, $P_0/P_5$ | Effective velocity coefficient, $C_v$ |       |         |
| 1.971   | 5.340                                     | 1.274                                  | 7648  | 60.57  | 4.97                                 | 0.502                           | 0.053                                     | 0.901                          | 0.0184                    | 5.894                     | 0.848   | 5795                                    | 34.40  | 28.80   | 0.825   | 0.045                                    | 0.5541                                | 1.000 | 121     |
| —   | 5.983                                     | 1.154                                  | 7439  | 59.20  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 2.713   | 8.723                                     | 1.093                                  | 7013  | 57.27  | 4.09                                 | .545                            | .056                                      | .909                           | .0117                     | 5.827                     | .853  | 3745                                    | 55.25  | 28.17   | .832  | .045                                     | .8489                                 | .958  | 122     |
| 3.465   | 2.616                                     | 1.026                                  | 6608  | 54.51  | 3.74                                 | .572                            | .062                                      | .773                           | .0108                     | 5.413                     | .859  | 3671                                    | 51.78  | 27.17   | .828  | .045                                     | .8877                                 | .880  | 124     |
| 2.180   | 5.427                                     | 1.248                                  | 8317  | 65.33  | 5.31                                 | .477                            | .054                                      | .923                           | .0184                     | 4.030                     | .880  | 3934                                    | 56.88  | 27.68   | 1.048   | .045                                     | .5711                                 | .962  | 126     |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 2.670   | 3.220                                     | 1.199                                  | 6063  | 62.66  | 5.04                                 | .495                            | .055                                      | .851                           | .0147                     | 3.874                     | .882  | 3935                                    | 38.17  | 27.14   | 1.006   | .047                                     | .8924                                 | .901  | 126     |
| 2.435   | 3.085                                     | 1.182                                  | 7837  | 62.47  | 4.77                                 | .505                            | .053                                      | .811                           | .0134                     | 5.908                     | .880  | 3904                                    | 36.19  | 27.98   | 1.095   | .046                                     | .6141                                 | .983  | 127     |
| 2.832   | 2.798                                     | 1.075                                  | 7441  | 64.45  | 4.37                                 | .598                            | .058                                      | .754                           | .0115                     | 3.832                     | .887  | 3688                                    | 35.38  | 28.17   | .903  | .044                                     | .8505                                 | 1.039 | 128     |
| 2.922   | 2.608                                     | 1.053                                  | 7048  | 54.47  | 4.03                                 | .540                            | .050                                      | .747                           | .0116                     | 3.872                     | .876  | 3948                                    | 37.80  | 28.55   | .915  | .045                                     | .6940                                 | 1.045 | 129     |
| 4.827   | 2.405                                     | .972                                   | 6804  | 54.36  | 5.64                                 | .560                            | .052                                      | .784                           | .0105                     | 5.513                     | .845  | 3734                                    | 32.58  | 28.28   | .945  | .045                                     | .7338                                 | .985  | 130     |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 10.800  | 2.186                                     | .807                                   | 5781  | 44.58  | 2.89                                 | .596                            | .053                                      | .642                           | .0097                     | 5.092                     | .818  | 3498                                    | 28.57  | 26.28   | .784  | .045                                     | .8028                                 | .984  | 131     |
| 1.927   | .848                                      | 3024                                   | 58.40   | 2.41   | .509                                 | .053                            | .421                                      | .0118                          | 5.857                     | .858                      | 3527  | 25.72                                   | 24.21  | .848  | .057  | .8538                                    | .984                                  | 132   |         |
| 2.812   | 3.109                                     | 1.080                                  | 6269  | 59.54  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | 39.01  | 26.90   | 1.087   | .054                                     | .8617                                 | 1.011 | 133     |
| 2.777   | 2.943                                     | 1.049                                  | 9065  | 62.18  | 4.88                                 | .485                            | .059                                      | .850                           | .0127                     | 4.380                     | .872  | 4059                                    | 38.17  | 1.089   | .053  | .8546                                    | .995                                  | 134   |         |
| 5.196   | 2.015                                     | 1.023                                  | 7054  | 62.49  | 4.85                                 | .492                            | .060                                      | .854                           | .0117                     | 4.985                     | .875  | 4038                                    | 38.54  | 27.94   | 1.100   | .061                                     | .8689                                 | .985  | 135     |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 5.812   | 2.610                                     | .888                                   | 7427  | 59.93  | 4.26                                 | .617                            | .061                                      | .822                           | .0107                     | 4.083                     | .869  | 3982                                    | 36.91  | 27.94   | 1.082   | .050                                     | .7228                                 | .971  | 136     |
| 6.176   | 2.457                                     | .958                                   | 7034  | 57.66  | 3.84                                 | .535                            | .063                                      | .804                           | .0103                     | 3.859                     | .849  | 3926                                    | 34.98  | 27.95   | 1.010   | .046                                     | .7631                                 | .976  | 137     |
| 5.254   | 2.418                                     | .947                                   | 7069  | 54.31  | 5.93                                 | .557                            | .064                                      | .718                           | .0107                     | 3.868                     | .882  | 3926                                    | 35.85  | 28.57   | .866  | .048                                     | .7658                                 | .988  | 138     |
| 9.029   | 2.285                                     | .918                                   | 8570  | 54.78  | 5.65                                 | .568                            | .064                                      | .710                           | .0098                     | 3.688                     | .855  | 3902                                    | 34.06  | 27.54   | .856  | .048                                     | .7670                                 | .971  | 139     |
| —   | 2.024                                     | .844                                   | 5758  | 44.73  | 2.85                                 | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 1.811   | .788                                      | 4089                                   | 58.58   | 2.35   | .591                                 | .065                            | .411                                      | .0107                          | 2.761                     | .855                      | 5521  | 26.89                                   | 24.71  | .854  | .040  | .8684                                    | .962                                  | 141   |         |
| 4.280   | 2.924                                     | 1.000                                  | 6268  | 63.45  | 4.98                                 | .478                            | .069                                      | .835                           | .0151                     | 4.835                     | .861  | 4181                                    | 40.02  | 27.19   | 1.189   | .060                                     | .7233                                 | .939  | 142     |
| 4.505   | 2.804                                     | .969                                   | 6093  | 62.91  | 4.78                                 | .482                            | .061                                      | .882                           | .0115                     | 4.843                     | .860  | 4144                                    | 39.66  | 27.44   | 1.189   | .067                                     | .7551                                 | .940  | 143     |
| 4.976   | 2.727                                     | .963                                   | 7905  | 63.28  | 4.62                                 | .481                            | .061                                      | .889                           | .0107                     | 4.808                     | .870  | 4102                                    | 38.40  | 28.18   | 1.185   | .062                                     | .7406                                 | .921  | 144     |
| 9.385   | 2.488                                     | .745                                   | 7449  | 63.00  | 4.23                                 | .517                            | .062                                      | .878                           | .0095                     | 4.280                     | .868  | 4083                                    | 38.00  | 29.18   | 1.156   | .051                                     | .7784                                 | .905  | 145     |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 70.300  | 2.194                                     | —                                      | 6592  | 51.85  | 3.53                                 | .558                            | .065                                      | .788                           | .0062                     | —                         | —   | 5887                                    | 33.90  | 28.51   | —   | —  | —                                     | —     | —       |
| 1.975   | .822                                      | 5764                                   | 49.44   | 2.91   | .591                                 | .063                            | .620                                      | .0063                          | 3.511                     | .854                      | 3606  | 30.84                                   | 27.95  | .854  | .046  | .8750                                    | .916                                  | 147   |         |
| 1.710   | .744                                      | 5010                                   | 36.01   | 2.31   | .800                                 | .070                            | .388                                      | .0050                          | 2.987                     | .850                      | 3414  | 27.37                                   | 24.07  | .874  | .036  | .9076                                    | 1.021                                 | 148   |         |
| 2.562   | .922                                      | 6218                                   | 55.06   | 4.82   | .486                                 | .065                            | .880                                      | .0068                          | 5.427                     | .861                      | 4285  | 42.78                                   | 27.97  | 1.385   | .061  | .8996                                    | .974                                  | 149   |         |
| 2.470   | .811                                      | 6086                                   | 53.61   | 4.61   | .479                                 | .063                            | .858                                      | .0095                          | 5.526                     | .853                      | 4396  | 41.73                                   | 27.45  | 1.322   | .061  | .9114                                    | .906                                  | 150   |         |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 2.378   | .788                                      | 7888                                   | 50.11   | 4.41   | .487                                 | .066                            | .828                                      | .0093                          | 5.288                     | .857                      | 4300  | 48.06                                   | 28.56  | 1.228   | .092  | .9153                                    | .977                                  | 151   |         |
| 2.210   | .787                                      | 7426                                   | 60.23   | 4.06   | .513                                 | .066                            | .813                                      | .0083                          | 4.838                     | .848                      | 4289  | 59.80                                   | 27.60  | 1.244   | .064  | .9274                                    | .929                                  | 152   |         |
| 2.079   | .789                                      | 7073                                   | 54.86   | 3.75   | .568                                 | .065                            | .713                                      | .0062                          | 4.893                     | .853                      | 4187  | 58.35                                   | 26.58  | 1.111   | .061  | .9551                                    | .964                                  | 153   |         |
| 1.960   | .744                                      | 6826                                   | 54.87   | 3.42   | .548                                 | .068                            | .694                                      | .0078                          | 4.838                     | .847                      | 4082  | 56.41                                   | 27.82  | 1.069   | .054  | .9435                                    | .982                                  | 154   |         |
| 1.783   | .735                                      | 5690                                   | 48.24   | 2.79   | .594                                 | .057                            | .598                                      | .0072                          | 5.544                     | .828                      | 3708  | 31.58                                   | 27.57  | .928  | .065  | .9600                                    | .790                                  | 155   |         |
| —   | —   | —                                      | —   | —  | —                                    | —                               | —   | —                              | —                         | —                         | —   | —                                       | —  | —   | —   | —  | —                                     | —     | —       |
| 1.664   | .730                                      | 4698                                   | 41.10   | 9.29   | .568                                 | .068                            | .327                                      | .0112                          | 2.914                     | .821                      | 3480  | 27.90                                   | 27.40  | .776  | .045  | .9731                                    | .853                                  | 156   |         |
| 1.182   | 5.003                                     | 2.542                                  | 6313  | 155.06   | 15.86                                | .872                            | .056                                      | .914                           | .0184                     | 5.080                     | .871  | 5747                                    | 42.81  | 28.08   | 1.517   | .064                                     | .3132                                 | .990  | 157     |
| 1.190   | 5.404                                     | 2.422                                  | 8988  | 189.76   | 15.45                                | .857                            | .057                                      | .917                           | .0155                     | 5.857                     | .863  | 5798                                    | 42.82  | 28.49   | 1.535   | .065                                     | .3365                                 | .968  | 158     |
| 1.638   | 5.113                                     | 1.958                                  | 6321  | 145.68   | 15.06                                | .868                            | .059                                      | .907                           | .0128                     | 6.874                     | .857  | 5934                                    | 44.46  | 28.58   | 1.587   | .060                                     | .5768                                 | .859  | 159     |
| 1.188   | 5.571                                     | 2.541                                  | 6122  | 162.37   | 15.38                                | .866                            | .056                                      | .926                           | .0188                     | 4.970                     | .870  | 5401                                    | 41.25  | 28.05   | 1.503   | .077                                     | .3056                                 | .974  | 160     |

TABLE I. - Continued. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Revolving<br>mass<br>index,<br>$\frac{D_2}{\sqrt{D_2}}$ | Variable<br>stator<br>position,<br>deg | Engine<br>speed,<br>RPM | Exhaust<br>nozzle<br>area,<br>$A_e$ ,<br>sq ft | Compressor-<br>inlet total<br>temper-<br>ature,<br>$T_2$ ,<br>°R | Compressor-<br>outlet<br>total<br>temper-<br>ature,<br>$T_3$ ,<br>°R | Turbine-<br>inlet<br>total<br>temper-<br>ature,<br>$T_4$ ,<br>°R | Exhaust<br>gas<br>total<br>temper-<br>ature,<br>(at<br>con-<br>trol),<br>$T_{5a}$ ,<br>°R | Compressor-<br>inlet total<br>pressure,<br>$P_2$ ,<br>lb<br>sq ft abs | Compressor-<br>outlet<br>total<br>pressure,<br>$P_3$ ,<br>lb<br>sq ft abs | Turbine-<br>inlet<br>total<br>pressure,<br>$P_4$ ,<br>lb<br>sq ft abs | Exhaust<br>nozzle-<br>inlet<br>total<br>pressure,<br>$P_5$ ,<br>lb<br>sq ft abs | Tank<br>static<br>pressure,<br>$P_0'$ ,<br>lb<br>sq ft abs | Engine<br>inlet<br>air-<br>flow,<br>$w_a$ ,<br>lb/sec | Over-<br>board<br>blown<br>air-<br>flow,<br>$w_b$ ,<br>lb/sec | Tail-<br>pipe<br>gas<br>flow,<br>$w_g$ ,<br>lb/hr | Fuel<br>flow,<br>$w_f$ ,<br>lb/hr | Jet<br>thrust,<br>$T_j$ ,<br>lb | Net<br>thrust,<br>$T_n$ ,<br>lb |      |     |
|---|--|-------------------------|--|--|--|--|---|---|---|---|---|--|---|---|---|-----------------------------------|---------------------------------|---------------------------------|------|-----|
| 161   | 0.194                                  | 0                       | 7690   | 2.946  | 417  | 1069   | 1892  | 1445  | 1407  | 187   | 2885  | 2442   | 451   | 140   | 16.72   | 0.18                              | 16.78                           | 885                             | 1098 | 741 |
| 162   | .125                                   |                         | 7257   | 4.875  | 417  | 1058   | 1850  | 1245  | 1245  | 195   | 2451  | 2303   | 367   | 243   | 16.67   | .14                               | 16.68                           | 706                             | 715  | 578 |
| 163   | .119                                   |                         | 7055   | 2.953  | 425  | 1058   | 1905  | 1370  | 1345  | 192   | 2443  | 2301   | 436   | 304   | 16.52   | .14                               | 16.55                           | 775                             | 1017 | 580 |
| 164   | .126                                   |                         | 7070   | 4.876  | 417  | 1051   | 1754  | 1190  | 1189  | 195   | 2354  | 2215   | 351   | 254   | 16.45   | .12                               | 16.35                           | 846                             | 686  | 545 |
| 165   | .121                                   |                         | 6707   | 2.391  | 425  | 1015   | 2053  | 1530  | 1510  | 195   | 2361  | 2249   | 521   | 493   | 15.35   | .16                               | 15.37                           | 866                             | 1099 | 770 |
| 166   | .114                                   |                         | 6712   | 2.610  | 425  | 1006   | 1801  | 1430  | 1375  | 185   | 2307  | 2176   | 456   | 354   | 15.45   | .18                               | 15.45                           | 762                             | 996  | 656 |
| 167   | .122                                   |                         | 6706   | 2.951  | 417  | 984  | 1776  | 1280  | 1245  | 185   | 2251  | 2097   | 398   | 356   | 15.54   | .17                               | 15.50                           | 845                             | 816  | 565 |
| 168   | .121                                   |                         | 6707   | 4.875  | 416  | 980  | 1848  | 1105  | 1110  | 185   | 2160  | 2019   | 522   | 212   | 15.52   | .17                               | 15.45                           | 543                             | 614  | 261 |
| 169   | .122                                   |                         | 6832   | 2.182  | 420  | 982  | 1986  | 1580  | 1499  | 196   | 2003  | 1801   | 460   | 460   | 12.32   | .16                               | 12.32                           | 788                             | 950  | 634 |
| 170   | .119                                   |                         | 6831   | 2.560  | 422  | 984  | 1854  | 1406  | 1370  | 192   | 1938  | 1850   | 425   | 402   | 12.37   | .11                               | 12.30                           | 645                             | 870  | 585 |
| 171   | .121                                   |                         | 6834   | 2.610  | 420  | 945  | 1728  | 1270  | 1243  | 194   | 1914  | 1805   | 577   | 351   | 13.28   | .14                               | 13.25                           | 585                             | 701  | 470 |
| 172   | .120                                   |                         | 6833   | 2.923  | 419  | 940  | 1621  | 1150  | 1150  | 192   | 1843  | 1767   | 532   | 300   | 13.38   | .15                               | 13.33                           | 510                             | 750  | 588 |
| 173   | .120                                   |                         | 6840   | 4.875  | 419  | 923  | 1497  | 985   | 1007  | 191   | 1823  | 1703   | 272   | 188   | 13.54   | .14                               | 13.45                           | 480                             | 449  | 133 |
| 174   | .118                                   |                         | 7450   | 2.652  | 422  | 1075   | 2077  | 1545  | 1499  | 192   | 2400  | 2267   | 473   | 447   | 15.25   | .14                               | 15.21                           | 888                             | 1032 | 745 |
| 175   | .122                                   |                         | 7477   | 2.961  | 425  | 1084   | 1850  | 1274  | 1274  | 195   | 2417  | 2276   | 427   | 367   | 10.82   | .14                               | 10.80                           | 780                             | 948  | 630 |
| 176   | .123                                   |                         | 7475   | 4.875  | 417  | 1080   | 1808  | 1220  | 1222  | 195   | 2330  | 2187   | 545   | 256   | 15.84   | .17                               | 15.80                           | 688                             | 833  | 594 |
| 177   | .121                                   |                         | 7257   | 2.936  | 425  | 1053   | 1859  | 1250  | 1258  | 195   | 2286  | 2154   | 494   | 388   | 15.17   | .15                               | 15.17                           | 706                             | 828  | 595 |
| 178   | .121                                   |                         | 7270   | 4.870  | 425  | 1028   | 1718  | 1150  | 1180  | 195   | 2013  | 2074   | 527   | 250   | 14.17   | .12                               | 15.15                           | 590                             | 622  | 278 |
| 179   | .081                                   | 0                       | 7410   | 2.954  | 420  | 1098   | 2087  | 1540  | 1484  | 190   | 1707  | 1613   | 506   | 277   | 11.61   | .10                               | 10.65                           | 814                             | 848  | 587 |
| 180   | .081                                   |                         | 7461   | 4.912  | 419  | 1093   | 1824  | 1370  | 1340  | 190   | 1672  | 1574   | 553   | 177   | 10.88   | .13                               | 10.81                           | 634                             | 533  | 313 |
| 181   | .083                                   |                         | 7270   | 2.858  | 420  | 1077   | 2085  | 1490  | 1459  | 191   | 1605  | 1593   | 301   | 279   | 11.79   | .07                               | 10.86                           | 868                             | 654  | 510 |
| 182   | .083                                   |                         | 7275   | 4.810  | 419  | 1068   | 1862  | 1310  | 1294  | 191   | 1625  | 1637   | 247   | 174   | 12.58   | .10                               | 10.87                           | 486                             | 580  | 264 |
| 183   | .084                                   |                         | 7463   | 5.373  | 456  | 1126   | 2051  | 1470  | 1437  | 190   | 1864  | 1756   | 308   | 266   | 11.88   | .15                               | 11.69                           | 807                             | 851  | 482 |
| 184   | .082                                   |                         | 6764   | 2.621  | 401  | 1084   | 2043  | 1534  | 1478  | 149   | 1817  | 1458   | 306   | 298   | 12.88   | .13                               | 9.75                            | 825                             | 597  | 397 |
| 185   | .082                                   |                         | 6788   | 2.636  | 402  | 1085   | 1996  | 1518  | 1455  | 148   | 1610  | 1426   | 502   | 282   | 12.1  | .08                               | 9.75                            | 616                             | 585  | 314 |
| 186   | .082                                   |                         | 6769   | 2.953  | 400  | 1064   | 1868  | 1390  | 1345  | 149   | 1479  | 1594   | 289   | 248   | 12.8  | .08                               | 9.85                            | 590                             | 474  | 211 |
| 187   | .081                                   |                         | 6784   | 4.808  | 401  | 1049   | 1757  | 1220  | 1212  | 147   | 1451  | 1512   | 223   | 178   | 10.07   | .14                               | 10.03                           | 549                             | 247  | 201 |

TABLE I. - Concluded. PERFORMANCE DATA OF XJ79-GE-1 TURBOJET ENGINE

| Specific<br>fuel<br>consumption,<br>$\frac{lb}{hr} \cdot \frac{lb}{lb}$<br>(hr)(lb thrust) | Engine-<br>total-<br>temperature<br>ratio,<br>$T_0/T_2$ | Engine-<br>total-<br>pressure<br>ratio,<br>$P_0/P_2$ | Compressor  |  |  |  | Combustor  |   |  |   | Turbine                                 |  |  |  | Tailpipe   |   | Ex. Nozzle  |       | Head-<br>ing |
|--|---|--|---|--|--|--|--|---|--|---|---|--|--|--|--|---|---|-------|--------------|
|  |   |  | Cor-<br>rected<br>engine<br>speed,<br>$N/\sqrt{T_2}$ ,<br>rpm | Cor-<br>rected<br>airflow,<br>$W_{a,2}/\sqrt{T_2}$ ,<br>lb/sec | Cor-<br>rected<br>compressor<br>pres-<br>sure<br>ratio,<br>$P_2/P_1$ | Cor-<br>rected<br>engine<br>effi-<br>ciency,<br>$\eta_0$ | Cor-<br>rector<br>total<br>pressure<br>loss<br>ratio,<br>$F_3/F_4$ | Combustor<br>effi-<br>ciency,<br>$\eta_B$ | Mol-<br>air<br>ratio,<br>$W_f/W_{a,5}$ | Turbine<br>pres-<br>sure<br>ratio,<br>$P_4/P_5$ | Turbine<br>effi-<br>ciency,<br>$\eta_T$ | Cor-<br>rected<br>turbine<br>speed,<br>$N$ | Cor-<br>rected<br>turbine<br>enthalpy<br>drop,<br>$\Delta H_T$ | Corrected<br>turbine<br>gas flow<br>$W_{a,4}/\sqrt{T_4}$ ,<br>lb/sec | Tailpipe<br>gas flow<br>parameter,<br>$W_{a,5}/\sqrt{T_5}$ | Tailpipe<br>total-<br>pressure<br>ratio,<br>$P_5/P_0$ | Exhaust<br>nozzle<br>effi-<br>ciency,<br>$\eta_N$ |       |              |
| 1.184  | 5.374   | 2.340  | 8121  | 180.98   | 13.16  | 0.658  | 0.068  | 0.905                                     | 0.0148                                 | 5.297   | 0.867                                   | 3764                                       | 43.16  | 28.47  | 1.364  | 0.085   | 0.3349  | 0.926 | 161          |
| 1.186  | 2.956   | 1.882  | 8107  | 182.07   | 13.57  | 0.680  | 0.060  | 0.945                                     | 0.0118                                 | 5.276   | 0.860                                   | 3915                                       | 46.04  | 28.78  | 1.605  | .558  | .892  | .958  | 162          |
| 1.140  | 3.180   | 2.271  | 7829  | 161.48   | 12.78  | .724   | 0.058  | 0.935                                     | 0.0154                                 | 5.278   | 0.844                                   | 3755                                       | 42.88  | 28.84  | 1.367  | .082  | .3510   | .985  | 163          |
| 1.185  | 2.801   | 1.619  | 7887  | 180.61   | 12.85  | .701   | 0.055  | 0.927                                     | 0.0111                                 | 6.313   | 0.862                                   | 3887                                       | 45.47  | 28.61  | 1.604  | .533  | .8187   | .968  | 164          |
| 1.149  | 3.570   | 2.672  | 7428  | 150.11   | 12.21  | .734   | 0.055  | 0.917                                     | 0.0163                                 | 4.317   | 0.848                                   | 3432                                       | 38.00  | 28.55  | 1.148  | .064  | .2798   | .985  | 165          |
| 1.168  | 3.961   | 2.363  | 7455  | 162.74   | 11.95  | .740   | 0.057  | 0.932                                     | 0.0158                                 | 4.772   | 0.859                                   | 3549                                       | 40.37  | 28.72  | 1.255  | .068  | .3153   | .968  | 166          |
| 1.168  | 2.986   | 2.031  | 7461  | 162.74   | 11.58  | .725   | 0.060  | 0.960                                     | 0.0117                                 | 5.349   | 0.867                                   | 3664                                       | 43.19  | 28.89  | 1.395  | .092  | .3557   | .975  | 167          |
| 2.271  | 2.885   | 1.668  | 7474  | 158.78   | 11.18  | .718   | 0.065  | 0.952                                     | 0.0099                                 | 5.270   | 0.869                                   | 3802                                       | 48.22  | 28.77  | 1.599  | .542  | .5911   | .948  | 168          |
| 1.181  | 3.389   | 2.459  | 7059  | 124.55   | 10.22  | .723   | 0.061  | 0.898                                     | 0.0168                                 | 5.344   | 0.868                                   | 3281                                       | 56.98  | 26.00  | 1.051  | .046  | .2874   | 1.010 | 169          |
| 1.186  | 3.246   | 2.903  | 7021  | 127.95   | 10.09  | .734   | 0.065  | 0.914                                     | 0.0141                                 | 4.328   | 0.862                                   | 3569                                       | 37.99  | 28.53  | 1.129  | .060  | .3010   | .997  | 170          |
| 1.181  | 2.980   | 1.943  | 7050  | 130.28   | 9.87   | .727   | 0.057  | 0.887                                     | 0.0118                                 | 4.788   | 0.858                                   | 3602                                       | 40.31  | 28.28  | 1.239  | .069  | .3553   | .980  | 171          |
| 1.151  | 2.897   | 1.729  | 7048  | 154.53   | 9.81   | .733   | 0.062  | 0.888                                     | 0.0108                                 | 5.382   | 0.867                                   | 3618                                       | 42.78  | 28.84  | 1.370  | .068  | .3493   | .978  | 172          |
| 3.253  | 2.405   | 1.424  | 7056  | 154.78   | 9.53   | .731   | 0.068  | 0.979                                     | 0.0069                                 | 6.281   | 0.859                                   | 3787                                       | 48.39  | 28.28  | 1.573  | .590  | .6811   | .988  | 173          |
| 1.186  | 3.552   | 2.464  | 8262  | 161.71   | 12.80  | .675   | 0.055  | 0.932                                     | 0.0166                                 | 4.793   | 0.868                                   | 3768                                       | 41.01  | 28.70  | 1.803  | .048  | .3498   | .982  | 174          |
| 1.184  | 3.241   | 9.157  | 8276  | 150.68   | 12.21  | .676   | 0.055  | 0.922                                     | 0.0140                                 | 5.338   | 0.871                                   | 3900                                       | 45.38  | 28.19  | 1.367  | .064  | .3928   | .980  | 175          |
| 2.068  | 2.950   | 1.759  | 8357  | 160.06   | 11.85  | .670   | 0.061  | 0.920                                     | 0.0118                                 | 5.339   | 0.850                                   | 4053                                       | 46.47  | 28.12  | 1.581  | .318  | .5737   | .959  | 176          |
| 1.174  | 3.071   | 2.061  | 8038  | 147.80   | 11.68  | .695   | 0.068  | 0.912                                     | 0.0350                                 | 5.352   | 0.875                                   | 3581                                       | 43.48  | 28.19  | 1.355  | .088  | .4986   | .892  | 177          |
| 2.101  | 2.748   | 1.688  | 8053  | 147.80   | 11.29  | .692   | 0.065  | 0.918                                     | 0.0107                                 | 5.343   | 0.862                                   | 4059                                       | 44.17  | 28.09  | 1.379  | .297  | .7043   | .958  | 178          |
| 1.185  | 3.533   | 2.354  | 8257  | 165.49   | 13.13  | .683   | 0.055  | 0.867                                     | 0.0183                                 | 5.271   | 0.858                                   | 3744                                       | 42.74  | 28.05  | 1.341  | .098  | .4880   | .994  | 179          |
| 1.700  | 3.198   | 1.845  | 8304  | 155.41   | 12.07  | .687   | 0.059  | 0.880                                     | 0.0141                                 | 6.218   | 0.856                                   | 3693                                       | 46.06  | 28.70  | .500   | .7119   | .850  | 180   |              |
| 1.141  | 5.428   | 2.298  | 8081  | 156.81   | 12.86  | .676   | 0.055  | 0.924                                     | 0.0151                                 | 5.282   | 0.859                                   | 3726                                       | 48.75  | 28.48  | 1.387  | .098  | .4375   | .981  | 181          |
| 1.687  | 3.080   | 1.848  | 8100  | 154.73   | 12.46  | .671   | 0.060  | 0.907                                     | 0.0151                                 | 6.205   | 0.855                                   | 3857                                       | 45.89  | 28.02  | 1.354  | .295  | .7184   | .947  | 182          |
| 1.343  | 3.188   | 8.063  | 7988  | 154.29   | 12.45  | .680   | 0.058  | 0.939                                     | 0.0144                                 | 5.701   | 0.859                                   | 3782                                       | 44.44  | 28.84  | 1.463  | .158  | .6482   | .985  | 183          |
| 1.322  | 3.198   | 8.084  | 7177  | 130.40   | 10.18  | .675   | 0.065  | 0.820                                     | 0.0182                                 | 4.680   | 0.862                                   | 3466                                       | 41.30  | 28.86  | 1.220  | .083  | .4208   | .982  | 184          |
| 1.318  | 3.148   | 8.027  | 7173  | 130.54   | 10.15  | .707   | 0.068  | 0.910                                     | 0.0180                                 | 4.719   | 0.865                                   | 3498                                       | 40.17  | 28.41  | 1.231  | .084  | .4321   | .983  | 185          |
| 1.481  | 2.911   | 1.805  | 7174  | 133.08   | 9.95   | .711   | 0.058  | 0.922                                     | 0.0150                                 | 5.175   | 0.850                                   | 5595                                       | 41.70  | 28.80  | 1.556  | .089  | .5143   | .813  | 186          |
| 1.935  | 2.628   | 1.817  | 7177  | 130.55   | 9.74   | .707   | 0.062  | 0.908                                     | 0.0108                                 | 6.018   | 0.847                                   | 3719                                       | 44.44  | 28.98  | 1.583  | .208  | .5144   | .870  | 187          |

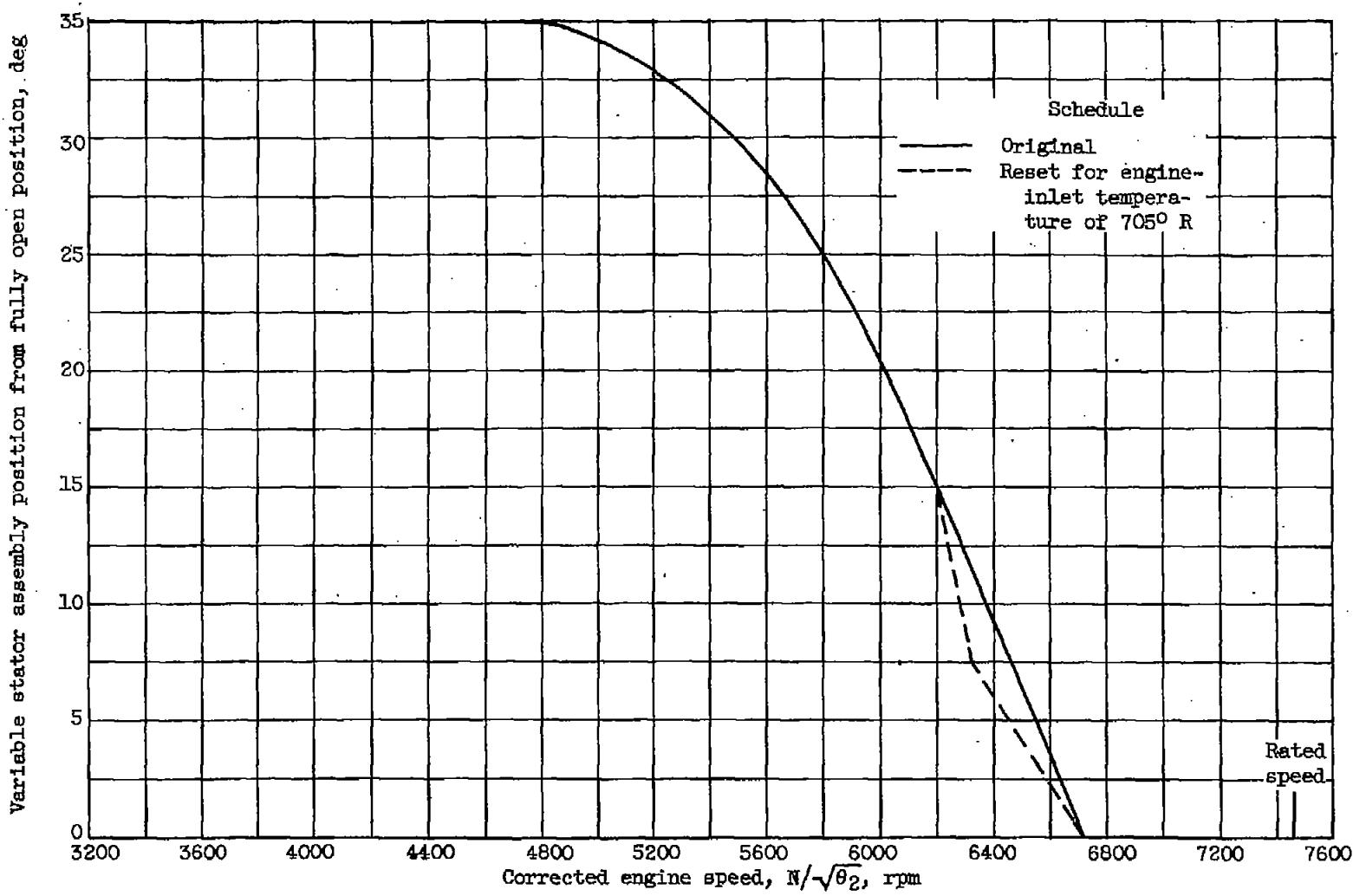


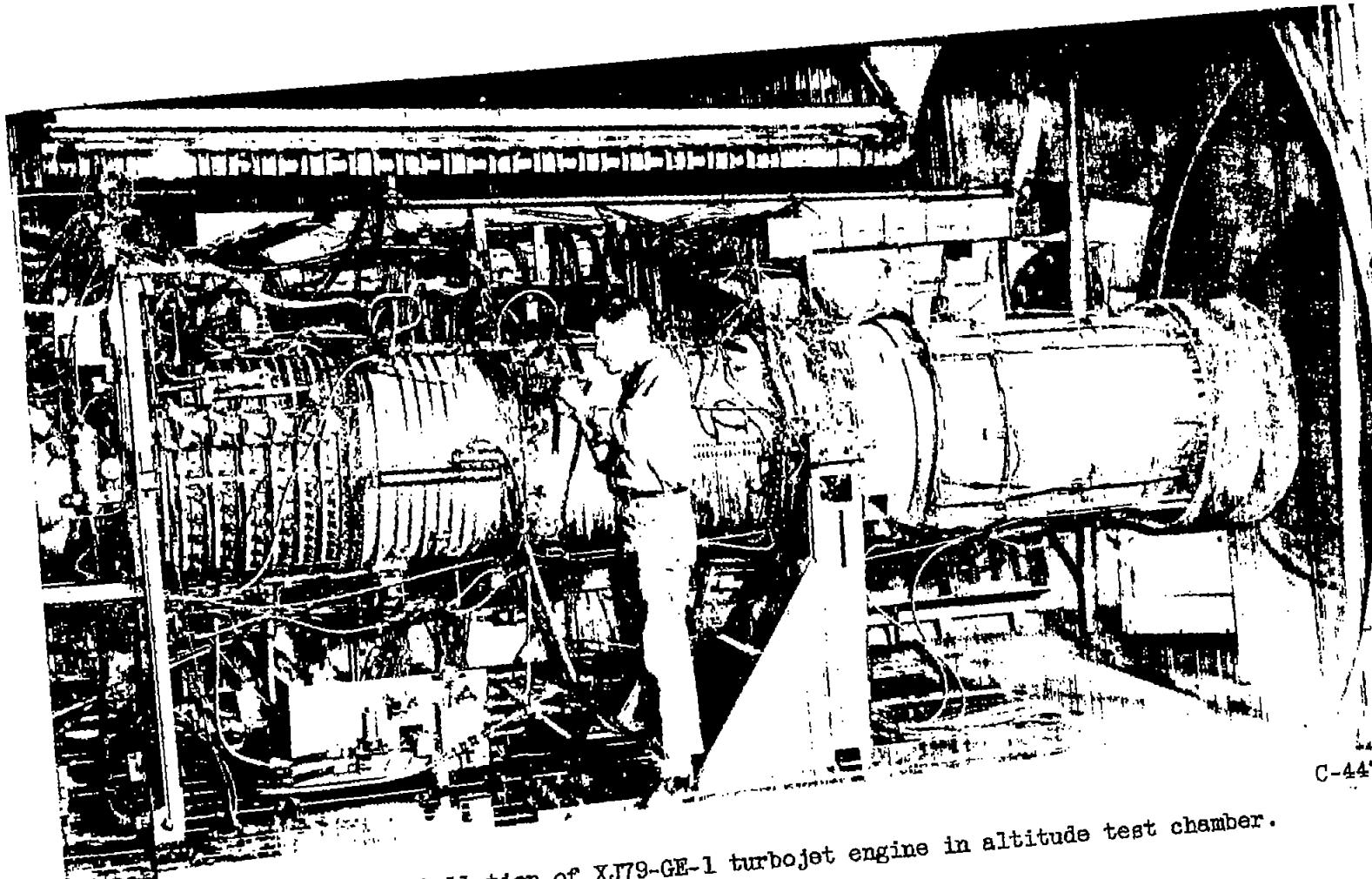
Figure 1. - The variation of variable-stator position with corrected engine speed for the original schedule and for the reset schedule in effect at an engine-inlet temperature of 705° R.

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Figure 2. - Installation of XJ79-GE-1 turbojet engine in altitude test chamber.

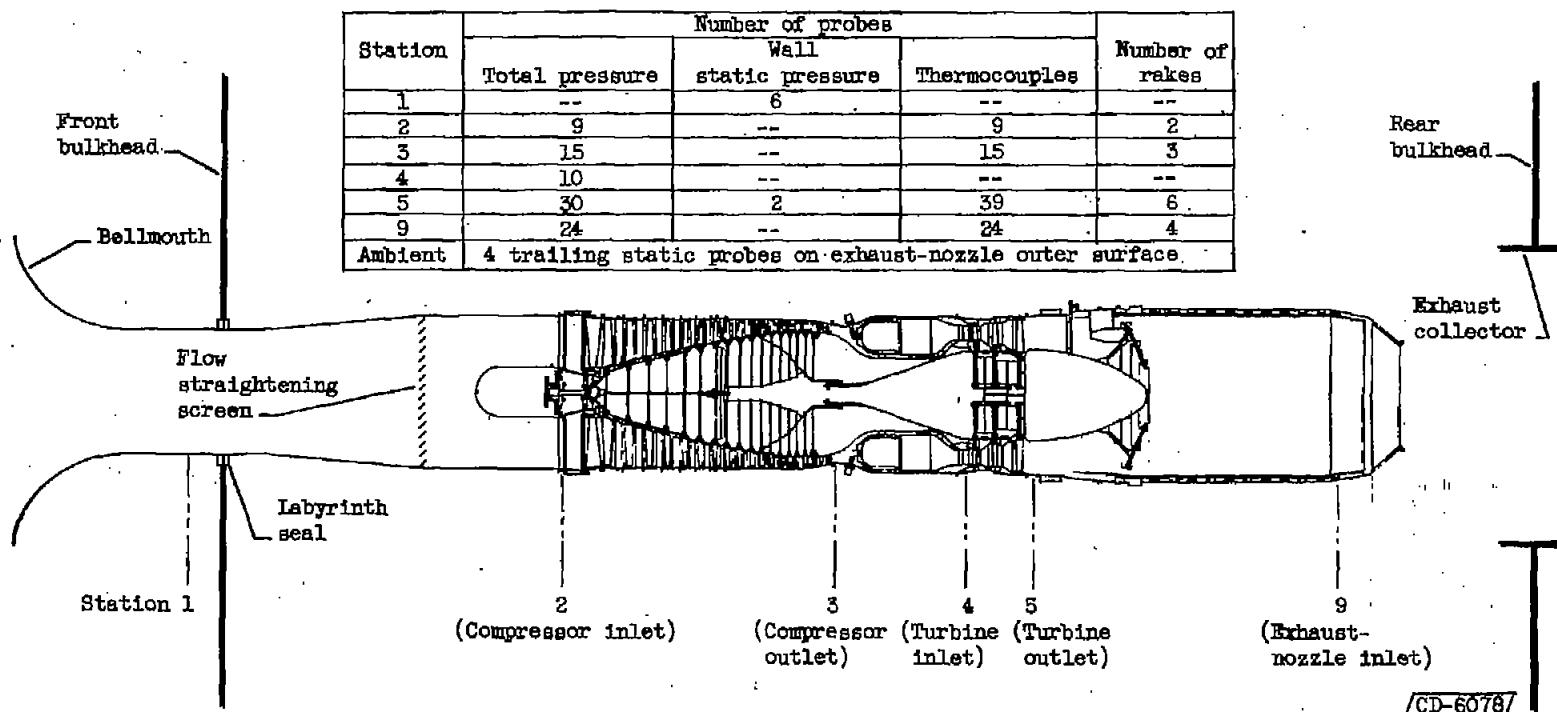
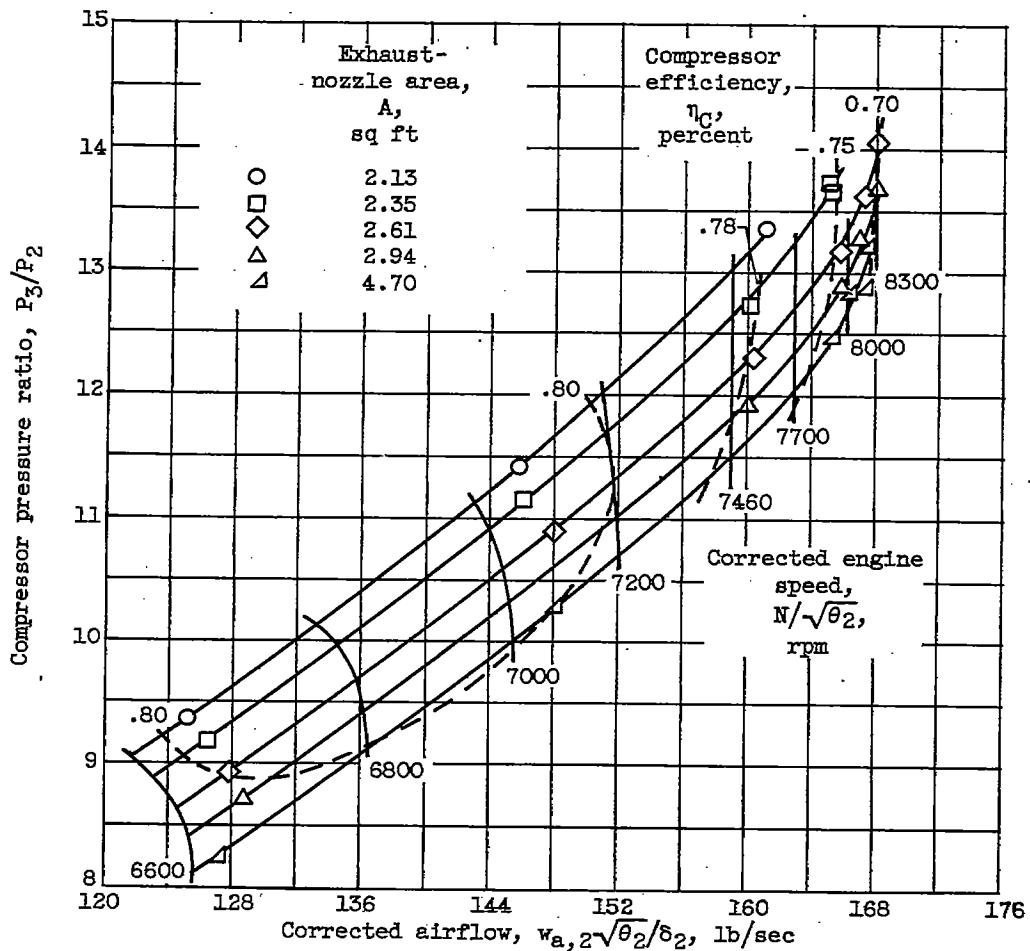


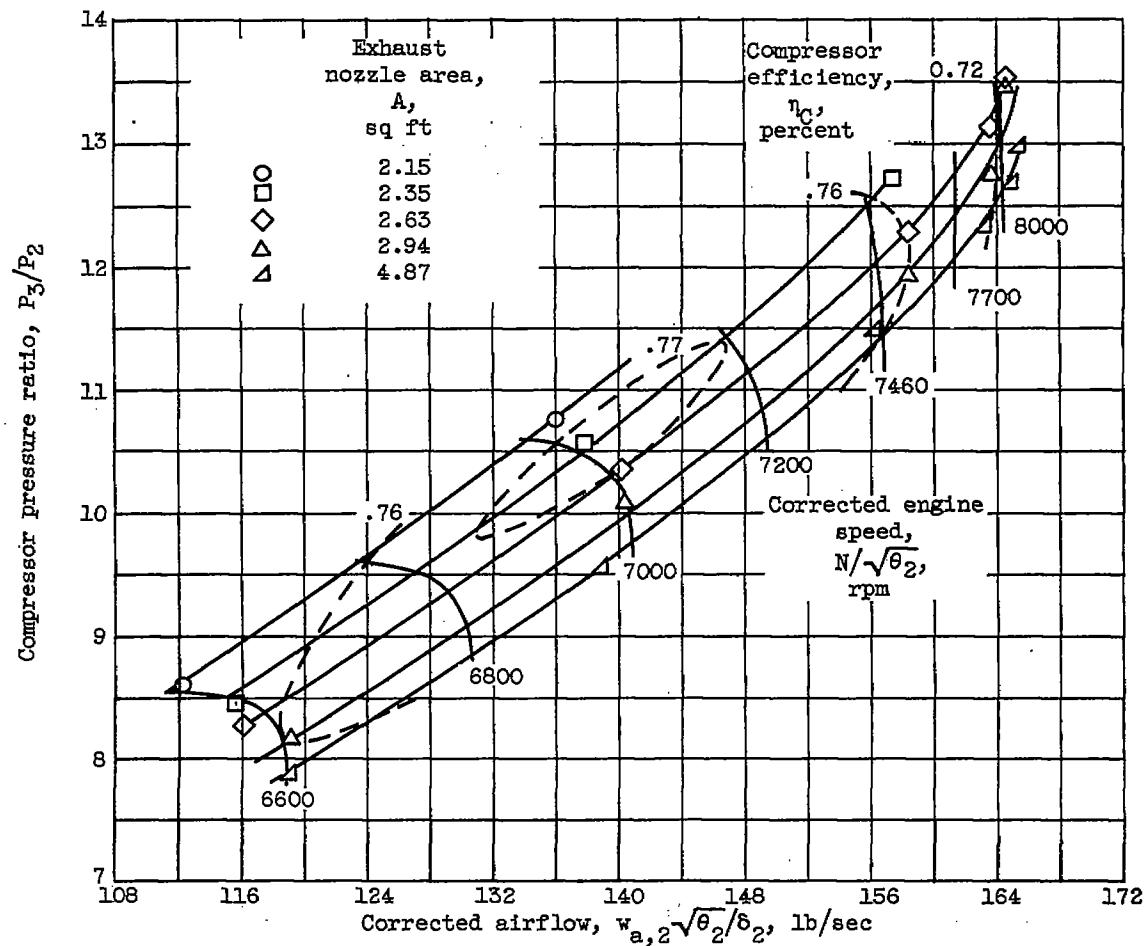
Figure 3. - Schematic diagram of engine and instrumentation stations.

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(a) Compressor-inlet Reynolds number index, 0.60; variable stators open.

Figure 4. - Compressor performance maps.



(b) Compressor-inlet Reynolds number index, 0.20; variable stators open.

Figure 4. - Continued. Compressor performance maps.

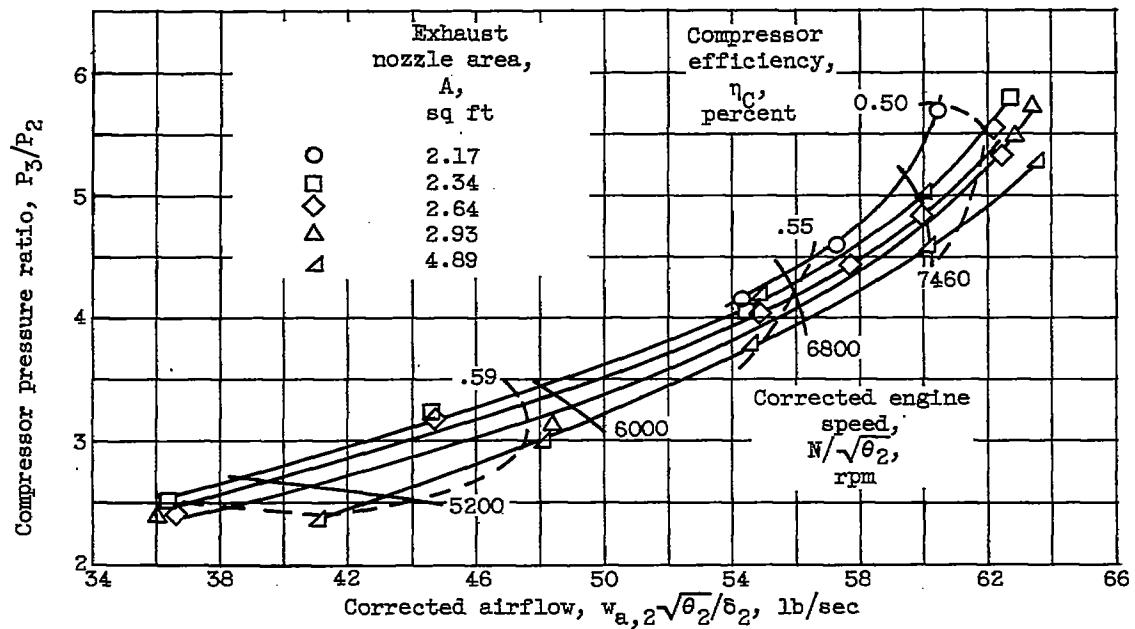
(c) Compressor-inlet Reynolds number index, 0.20; variable stators closed ( $35^\circ$ ).

Figure 4. - Concluded. Compressor performance maps.

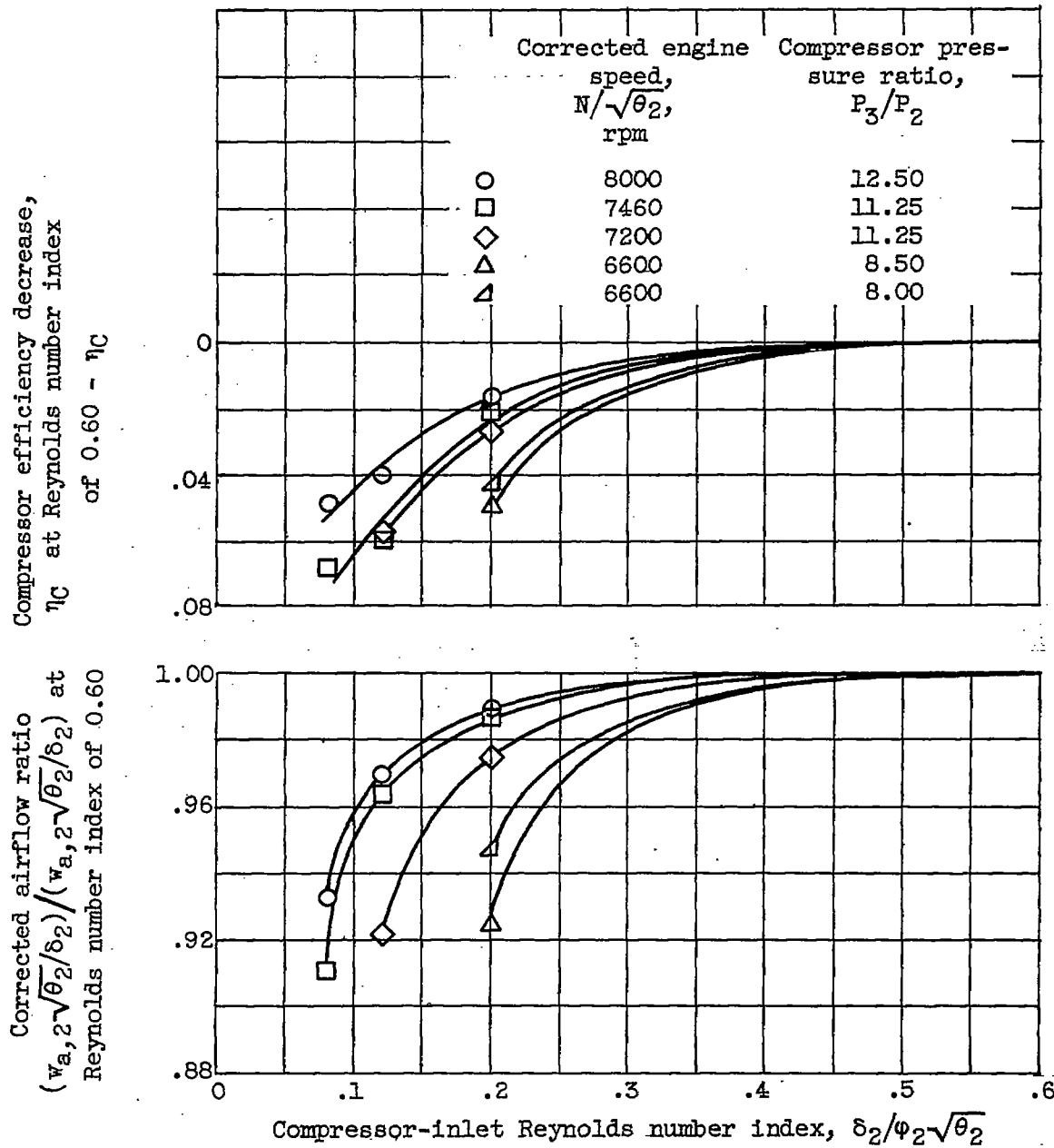
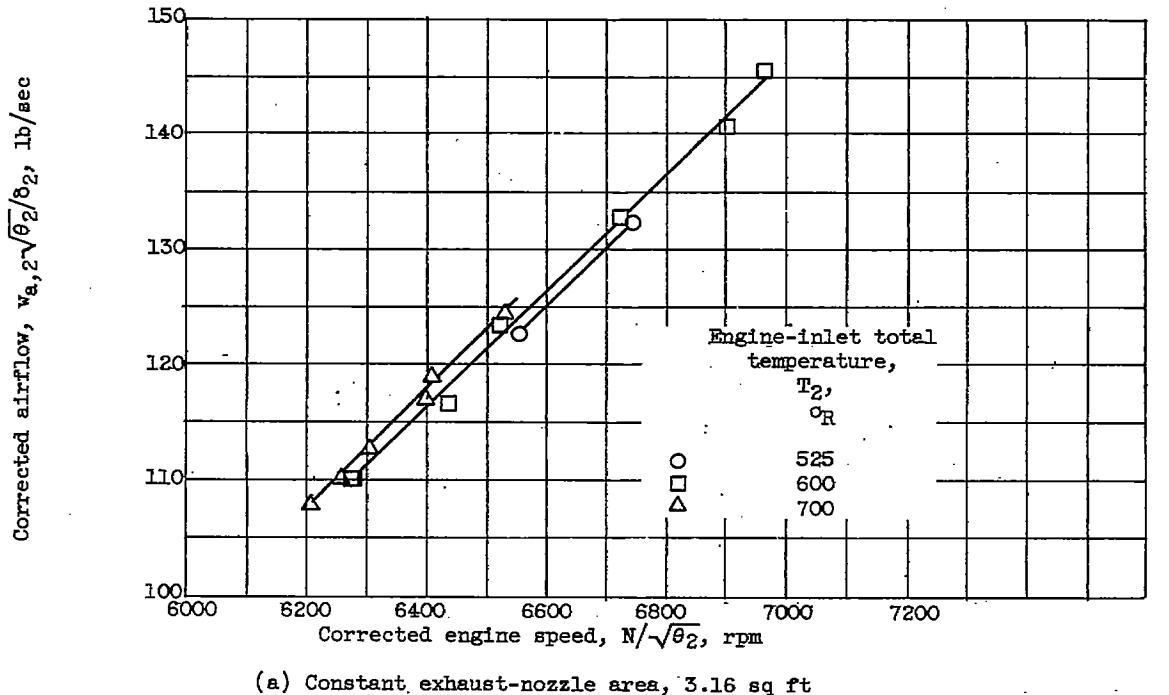
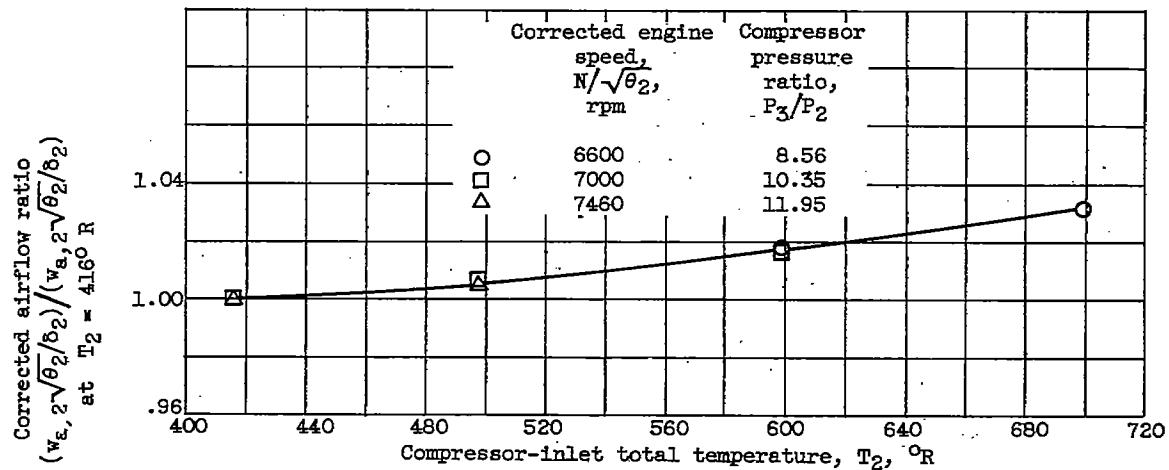


Figure 5. - Reynolds number effects on compressor performance. Variable stators open.

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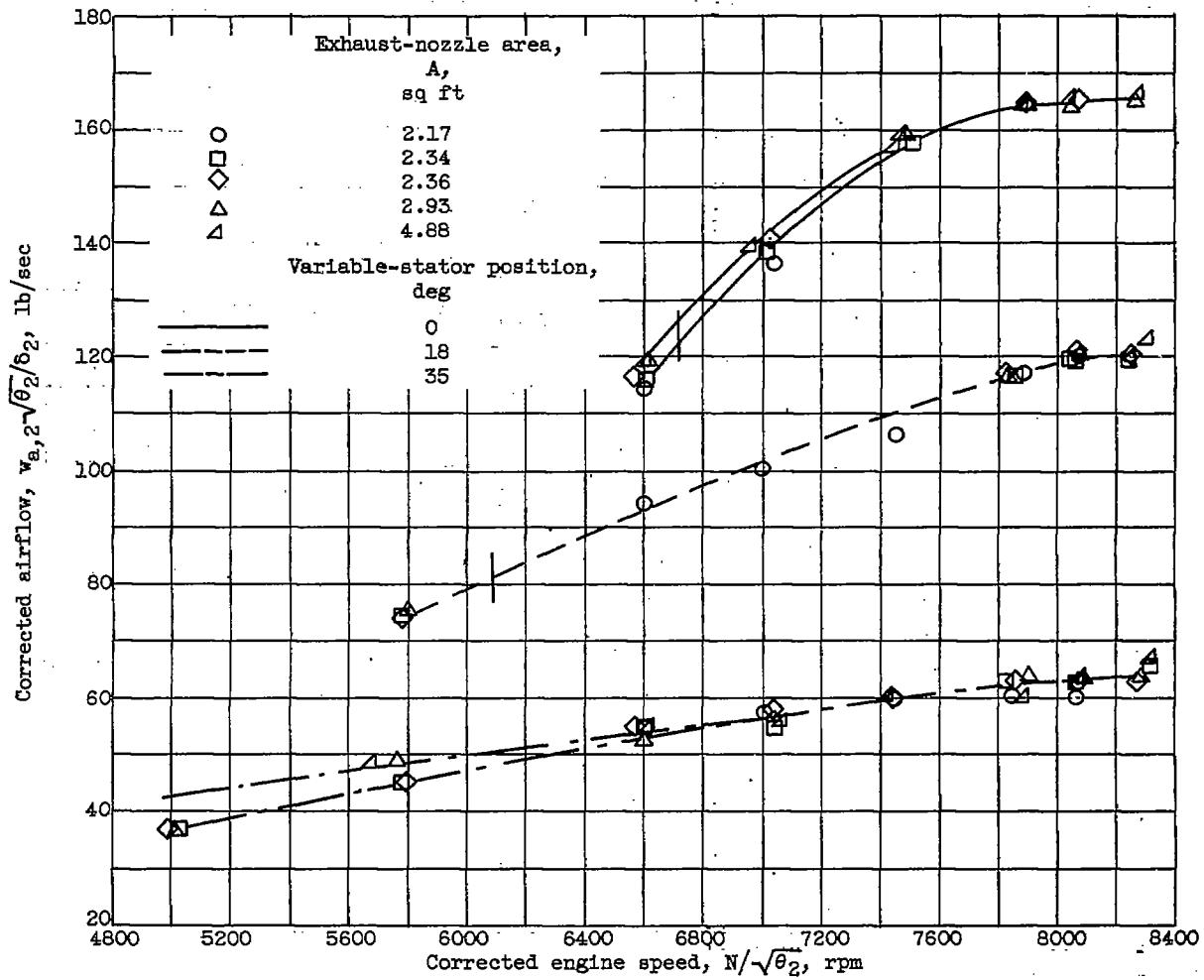


(a) Constant exhaust-nozzle area, 3.16 sq ft



(b) Constant corrected engine speed and compressor pressure ratio.

Figure 6. - Effect of inlet temperature on corrected airflow. Reynolds number index, 0.4; variable stators open.



(a) Corrected airflow.

Figure 7. - Effect of variable-stator position on compressor performance at Reynolds number index of 0.20.

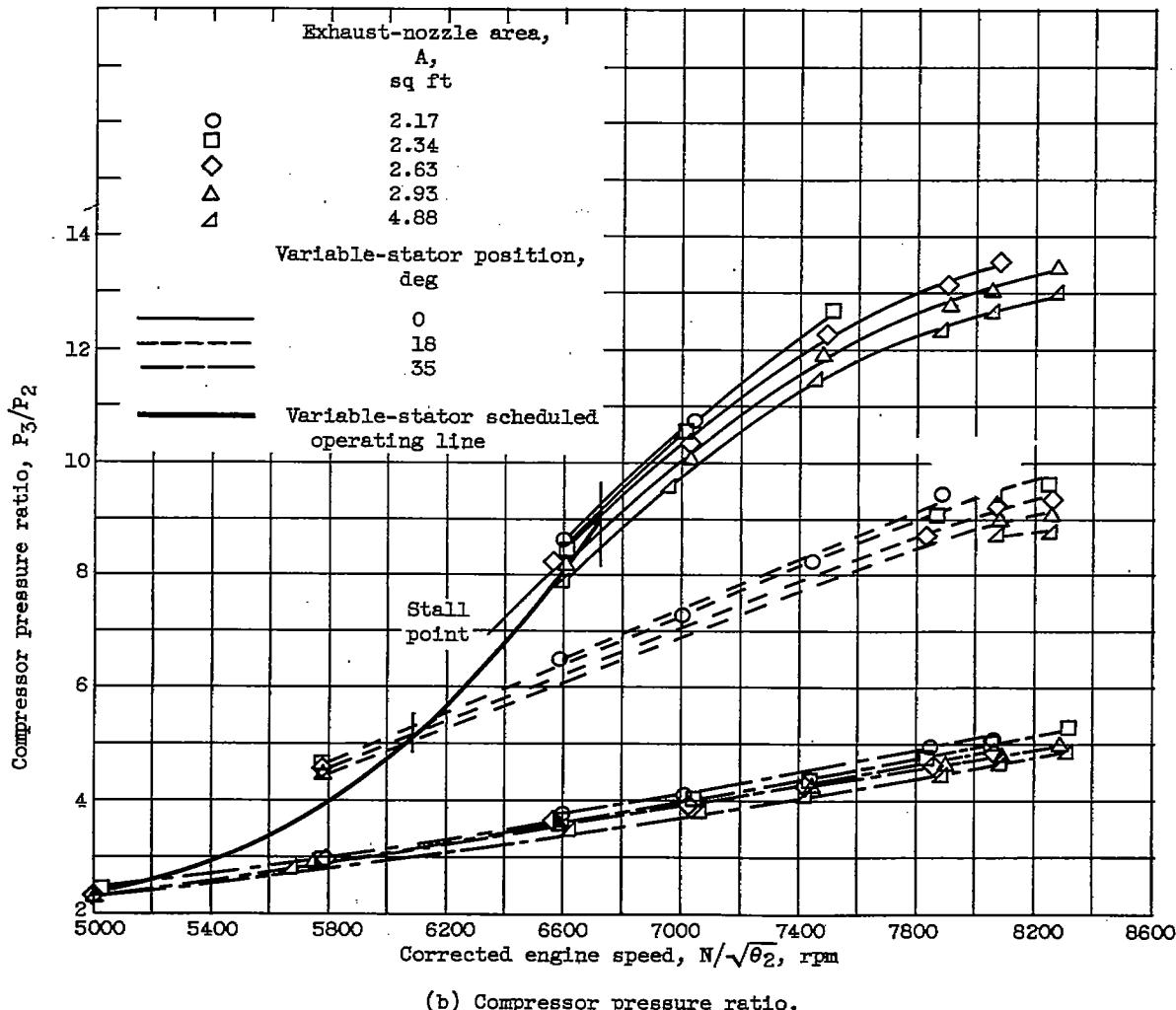
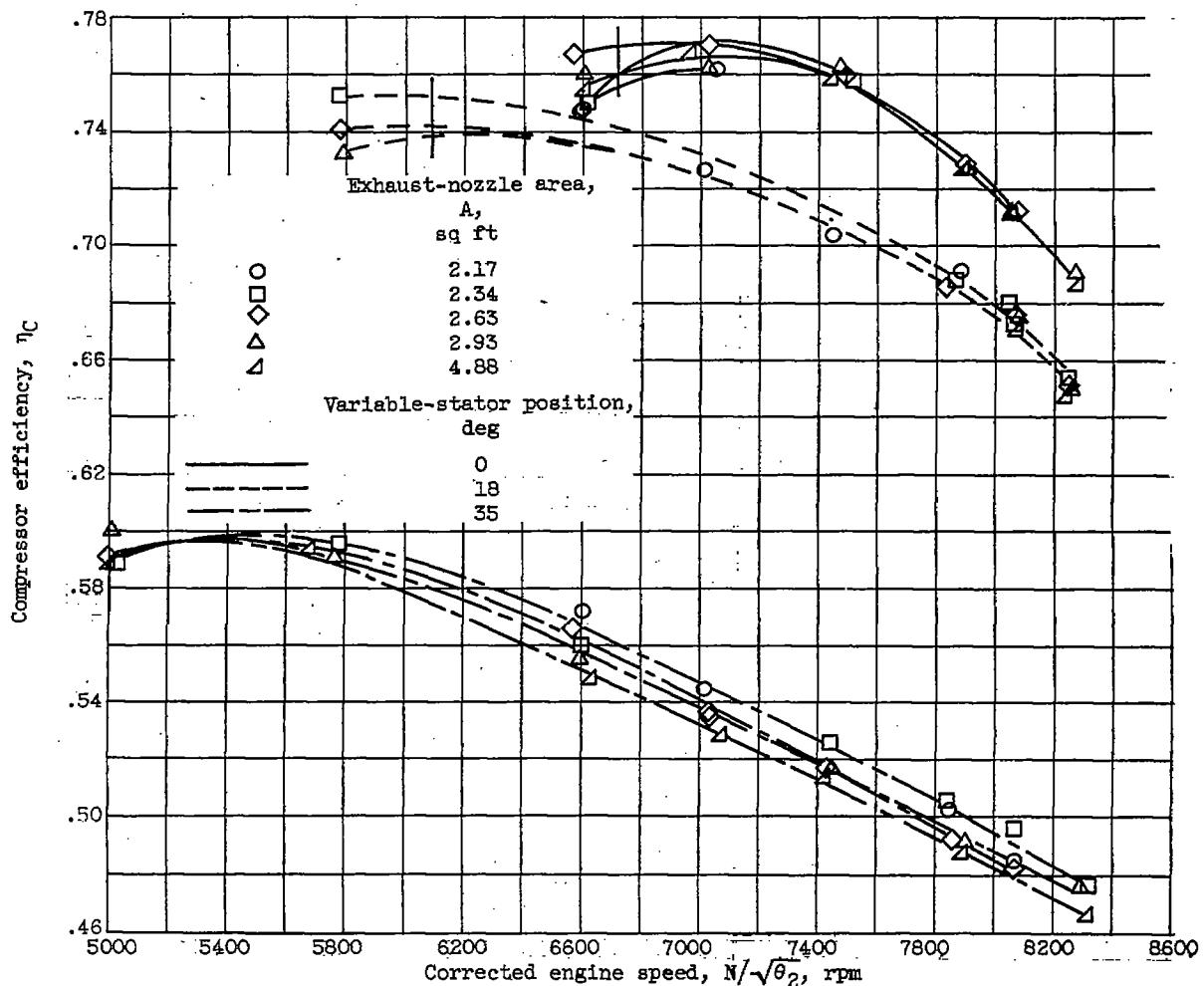


Figure 7. - Continued. Effect of variable stator position on compressor performance at Reynolds number index of 0.20.

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(c) Compressor efficiency.

Figure 7. - Concluded. Effect of variable stator position on compressor performance at Reynolds number index of 0.20.

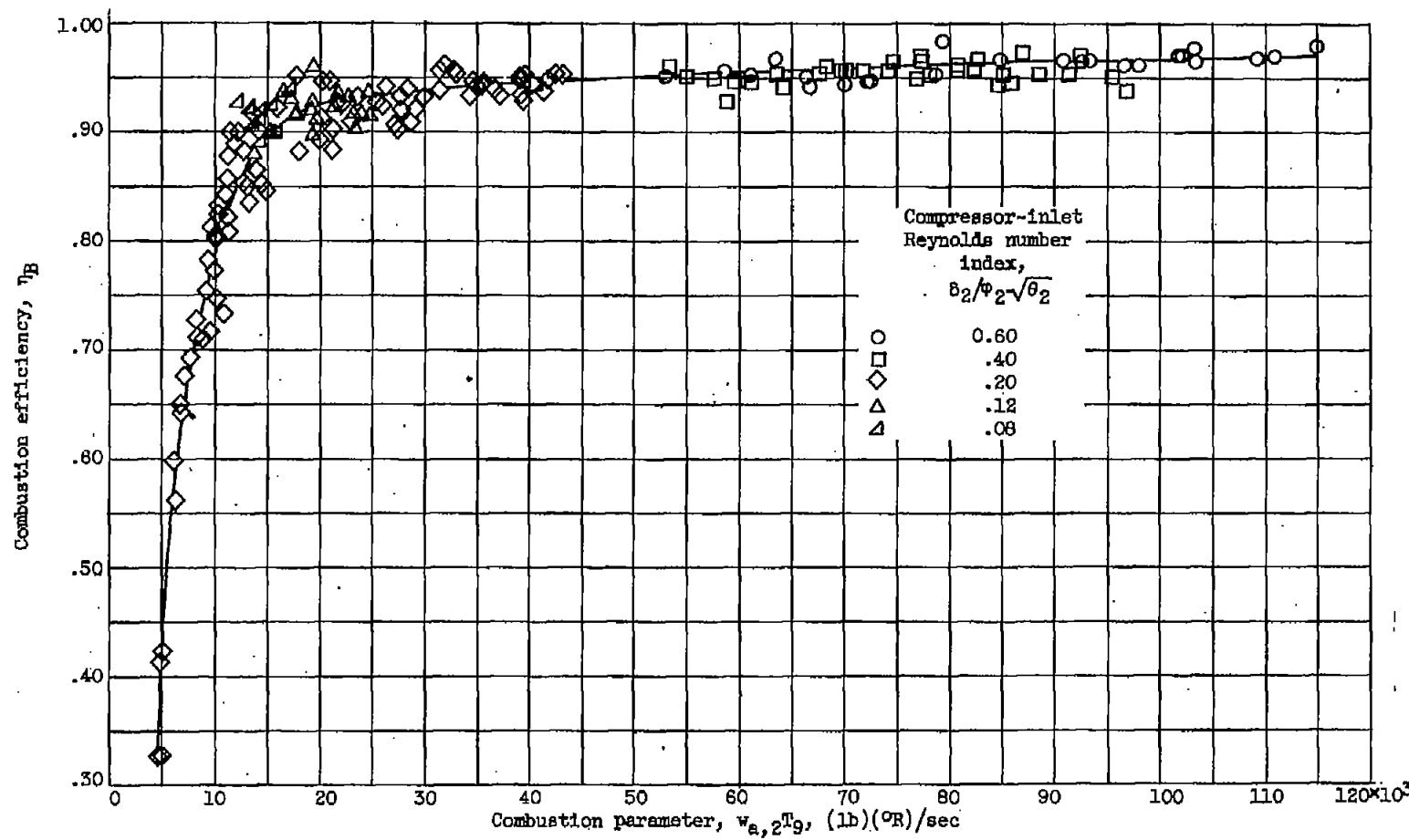


Figure 8. - Combustion efficiency.

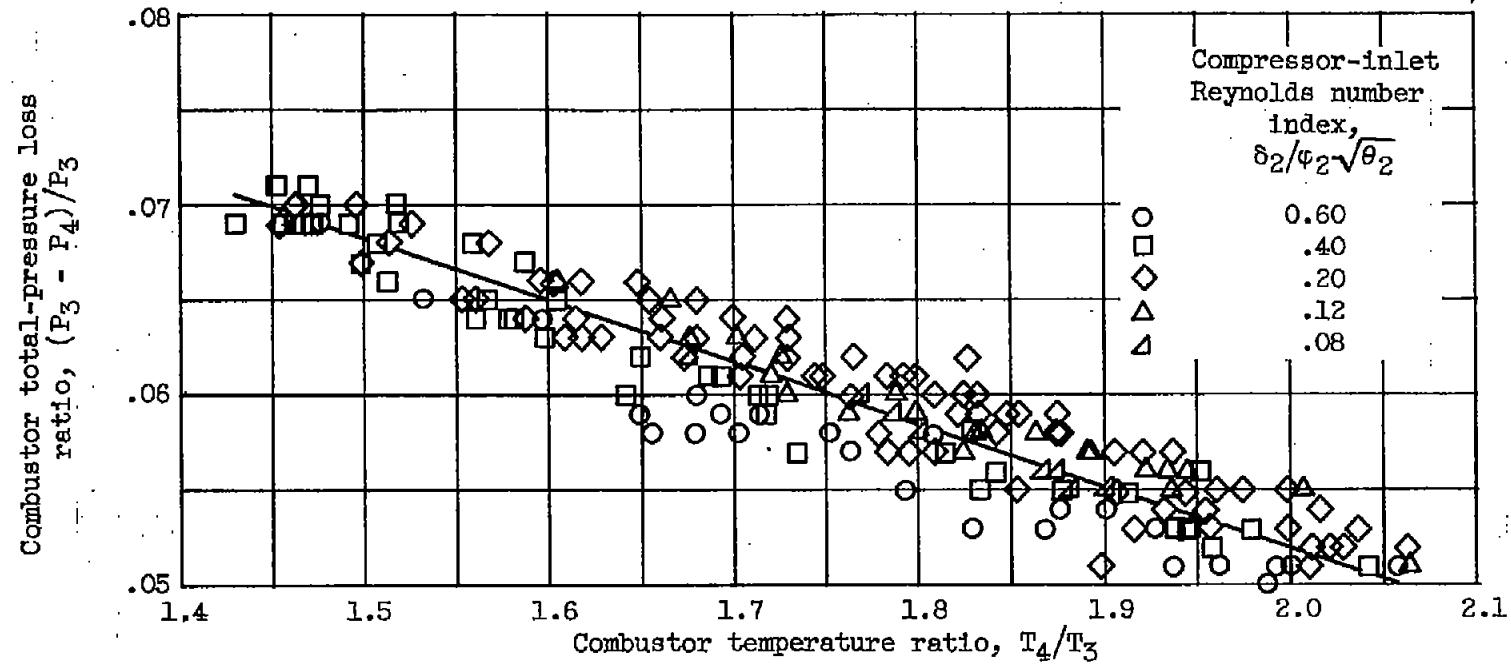
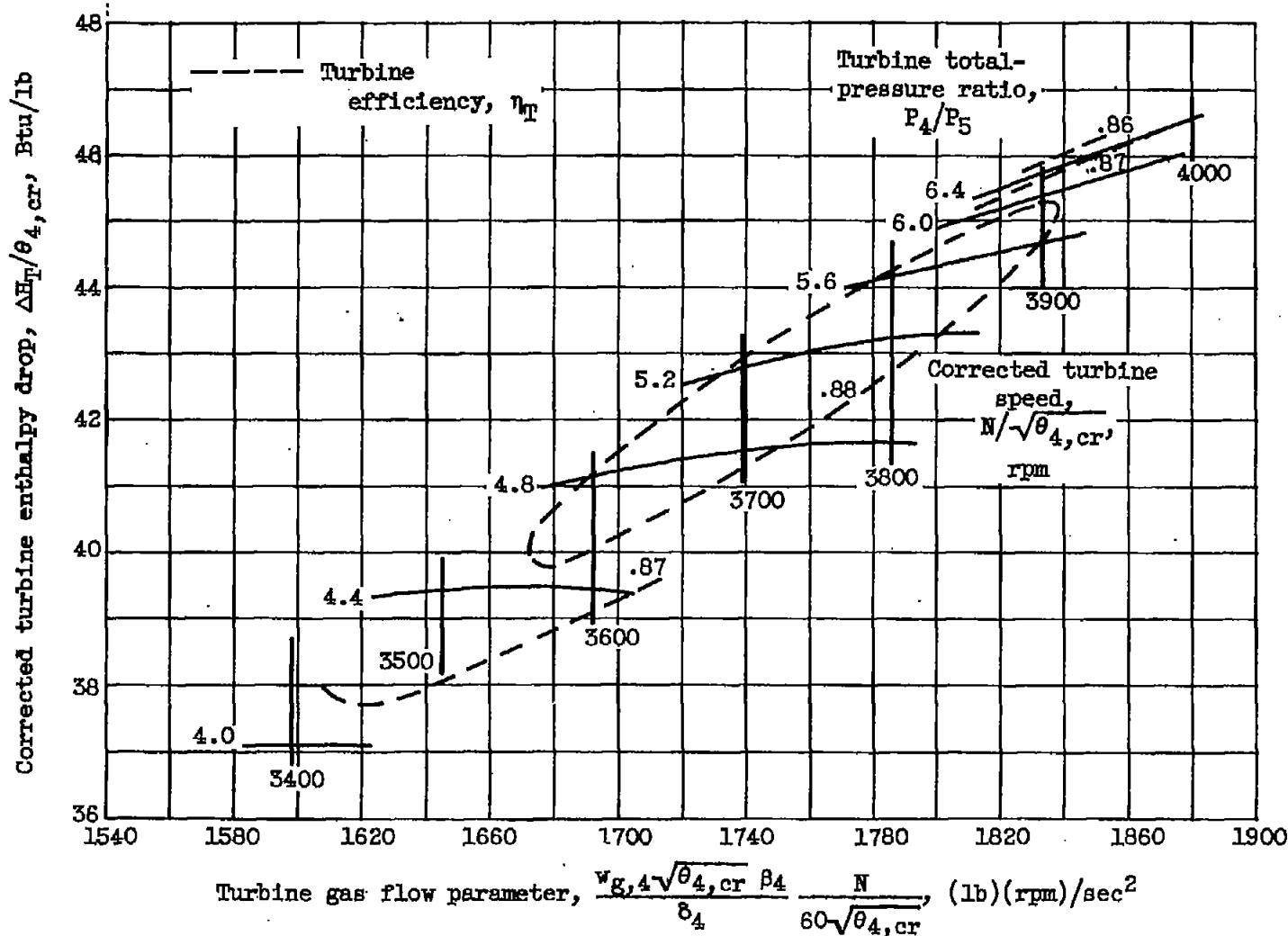
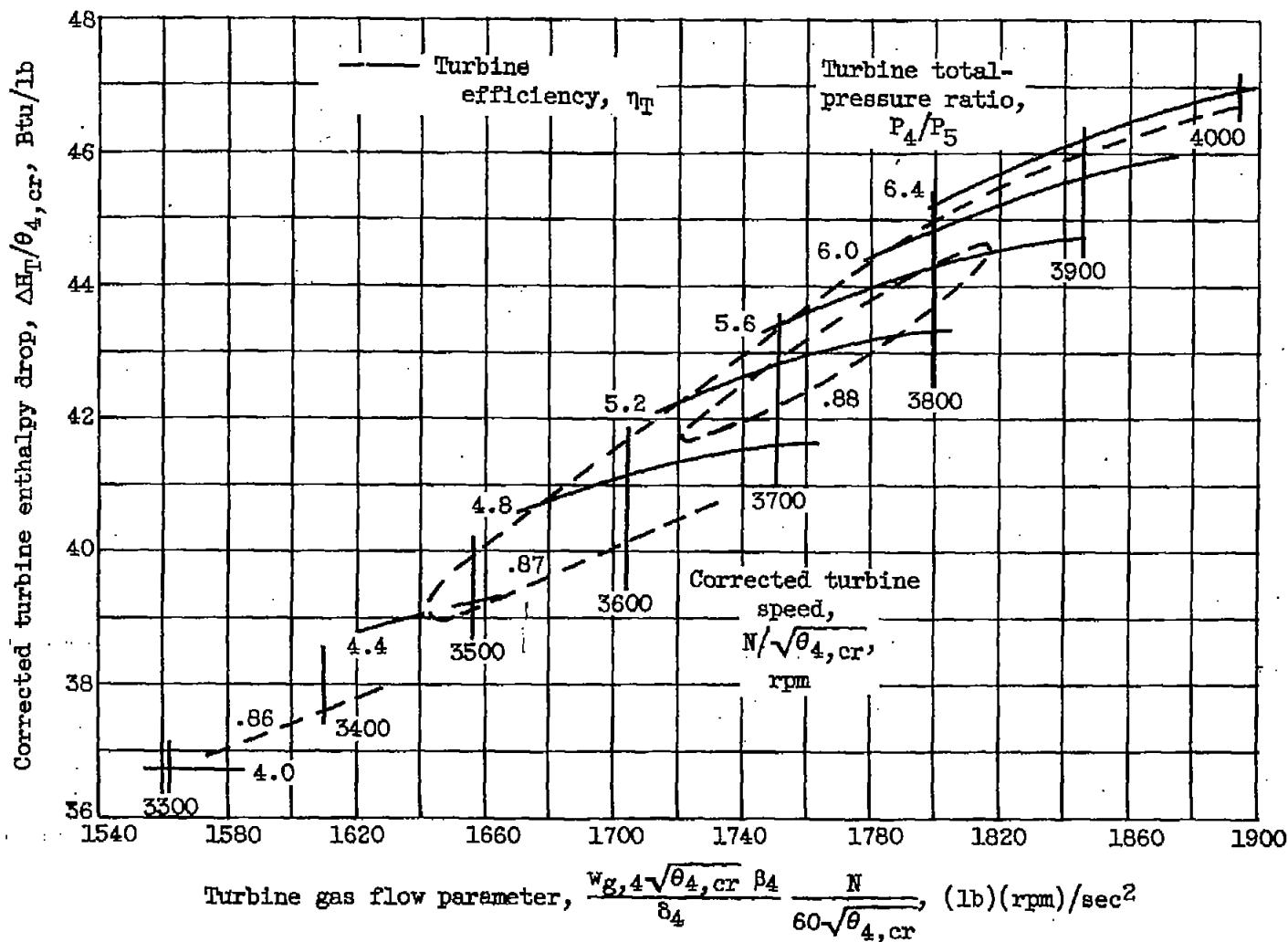


Figure 9. - Combustor total-pressure loss.



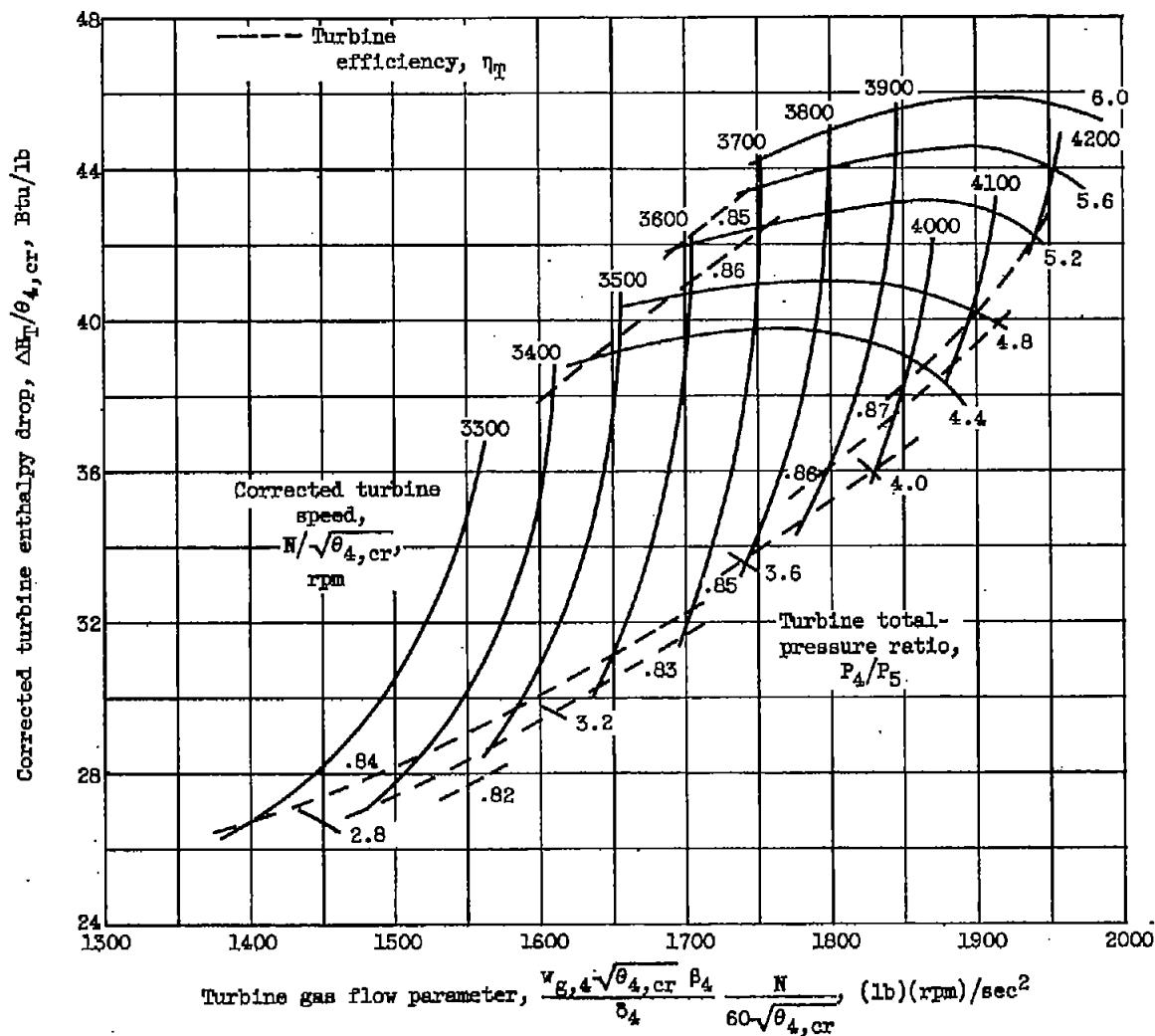
(a) Turbine-inlet Reynolds number index, 1.04 to 1.41.

Figure 10. - Turbine performance maps.



(b) Turbine-inlet Reynolds number index, 0.29 to 0.43.

Figure 10. - Continued. Turbine performance maps.



(c) Turbine-inlet Reynolds number index, 0.13 to 0.19.

Figure 10. - Concluded. Turbine performance maps.

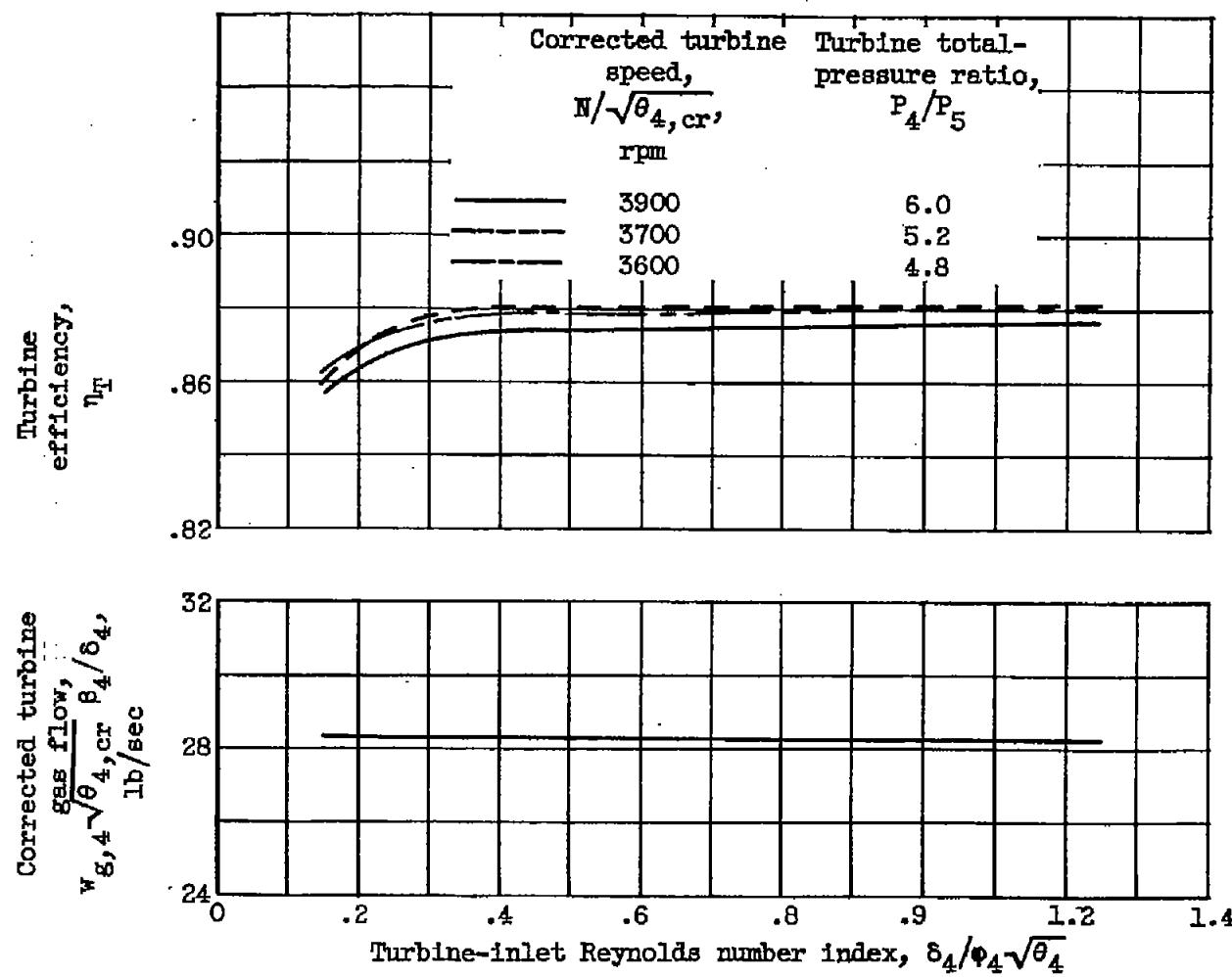


Figure 11. - Reynolds number effects on turbine performance.

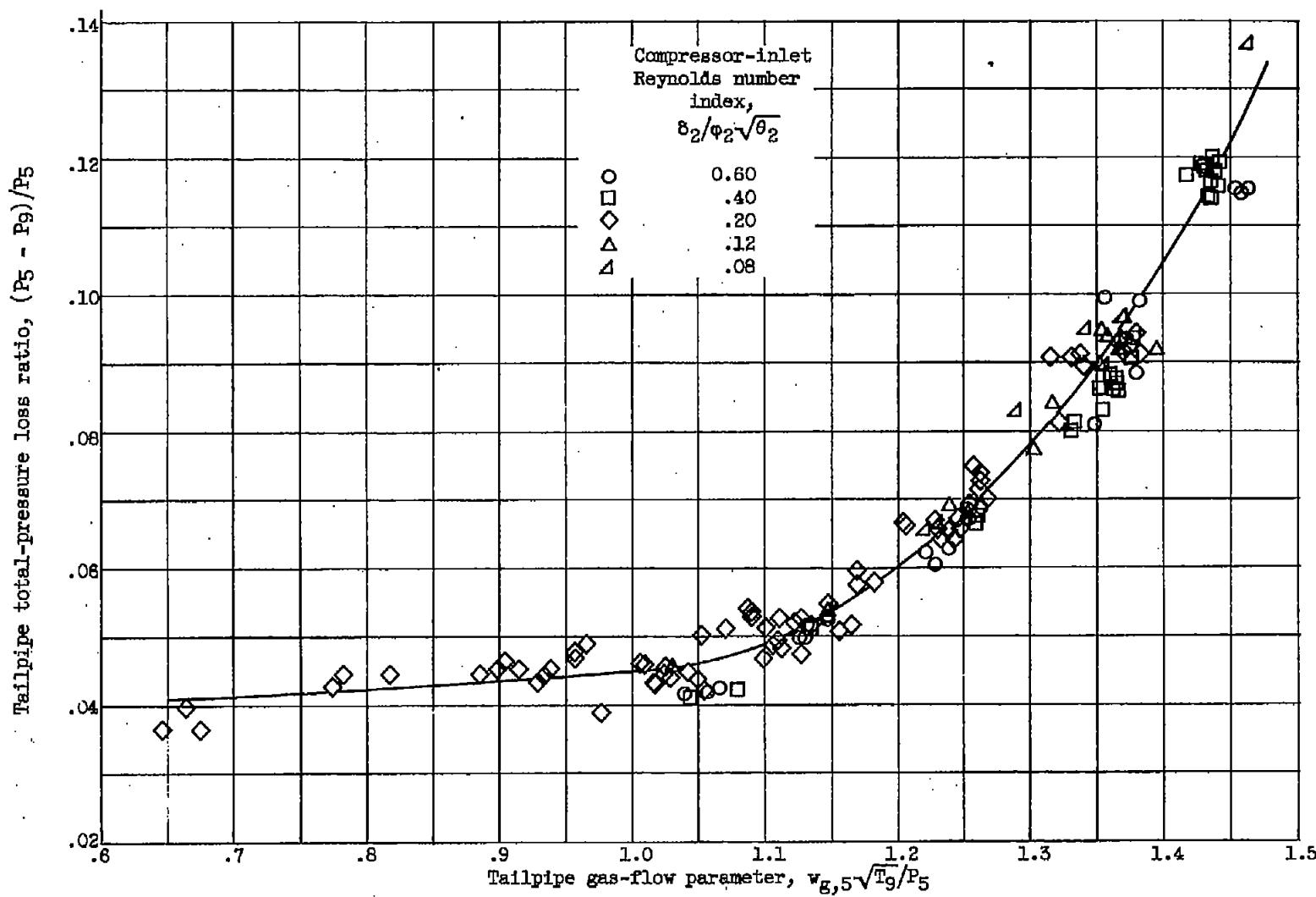


Figure 12. - Tailpipe total-pressure loss.

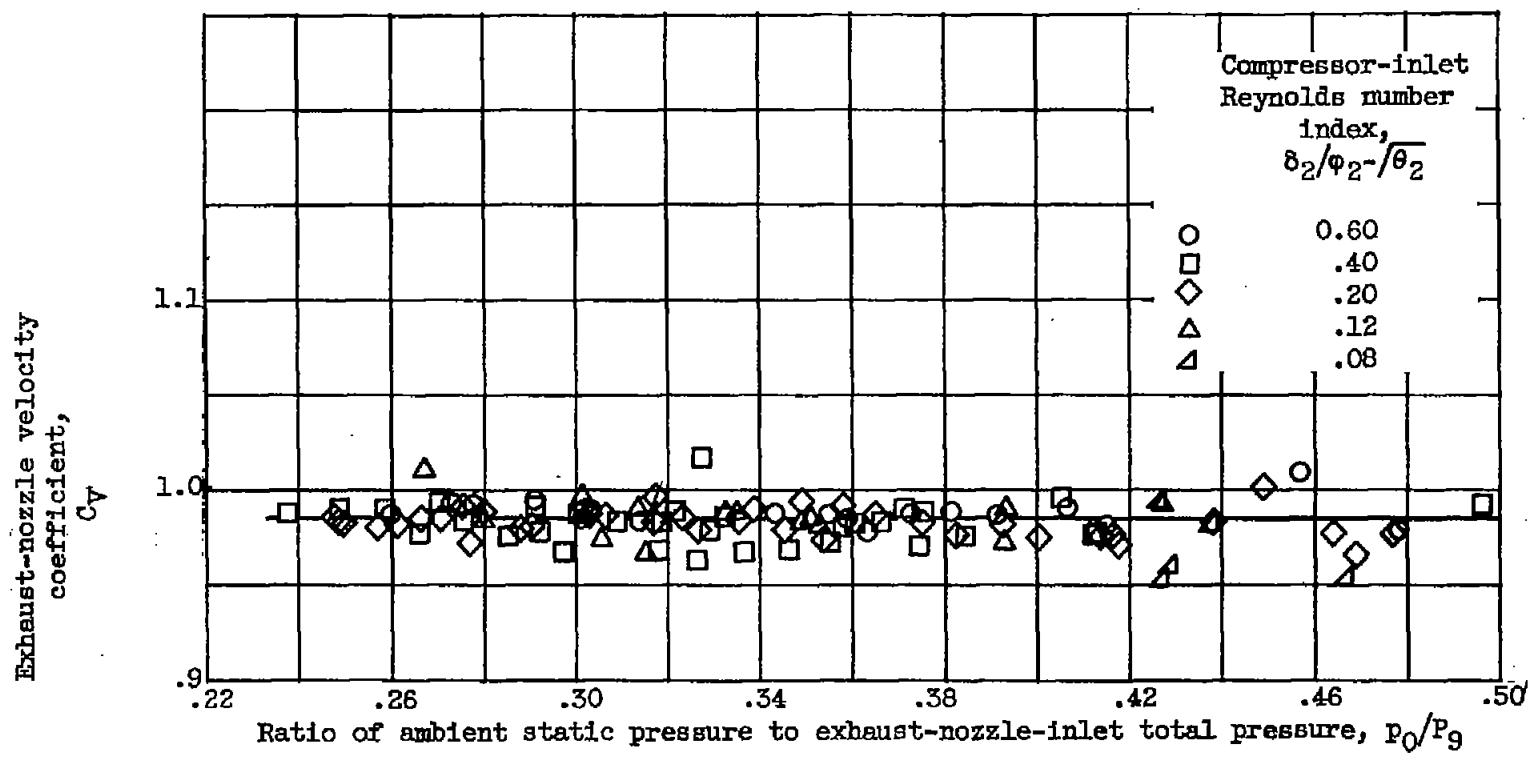


Figure 13. - Exhaust-nozzle velocity coefficient.

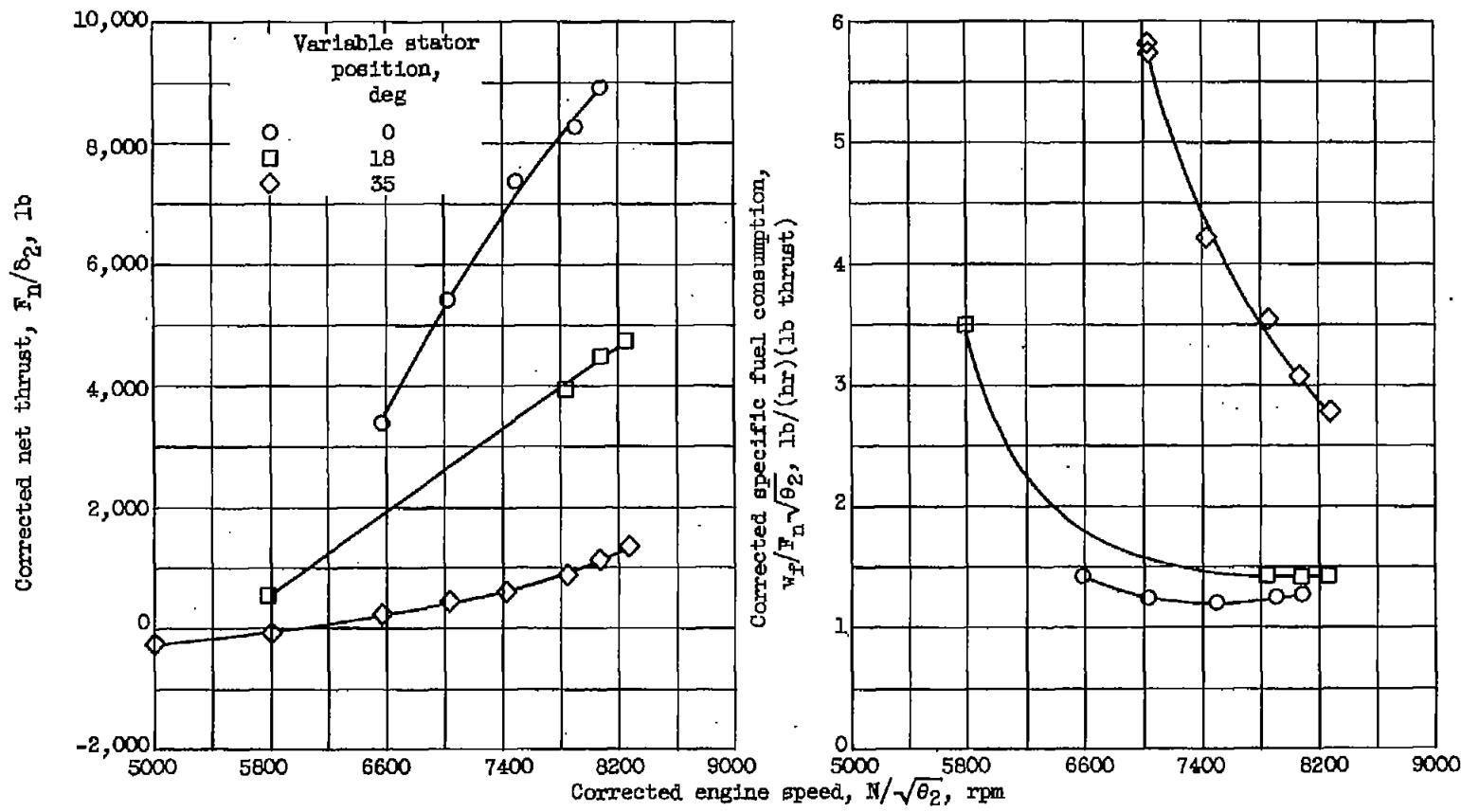
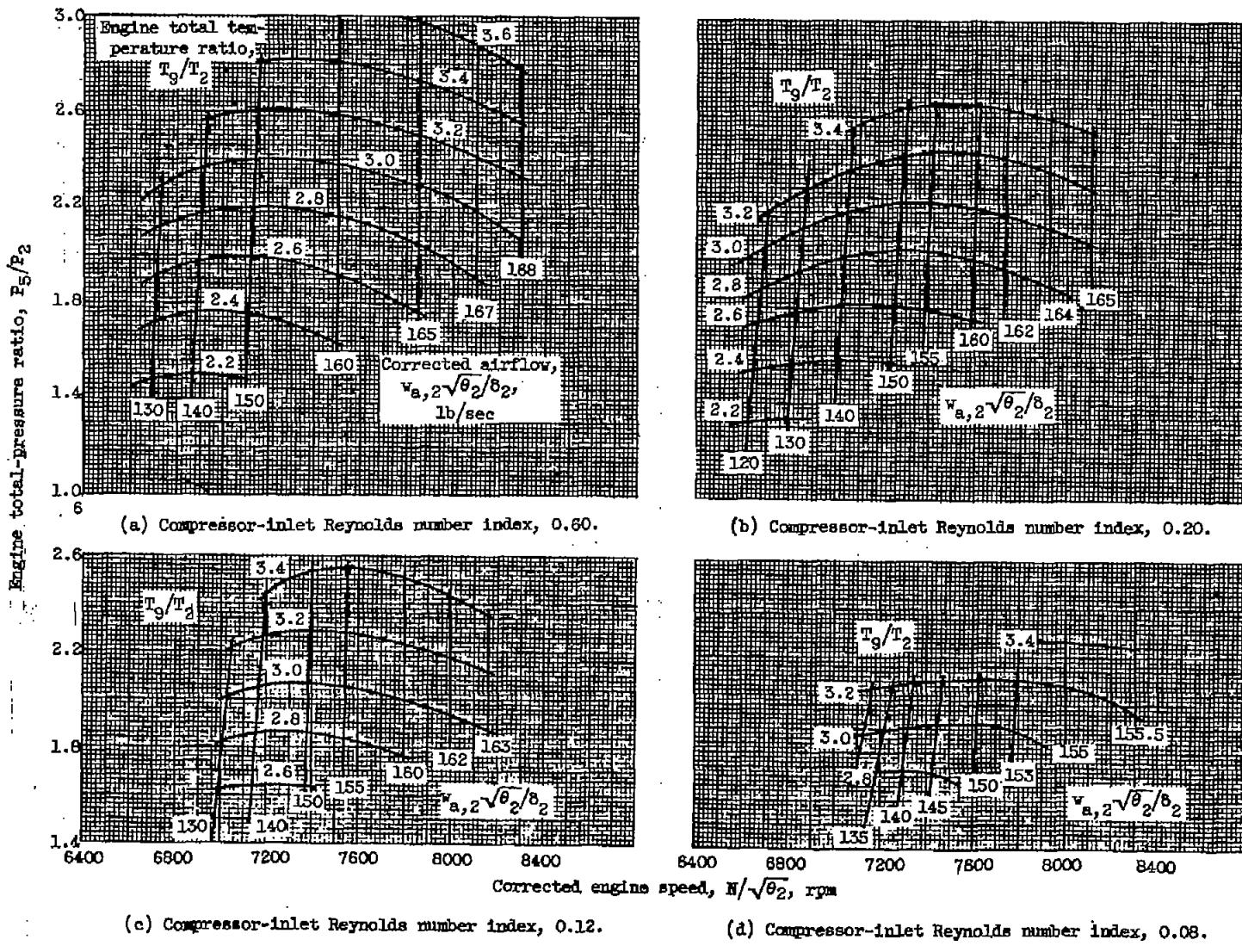


Figure 14. - Effect of variable stator position on engine performance. Flight Mach number, 0.77; exhaust-nozzle area, 2.83 square feet.



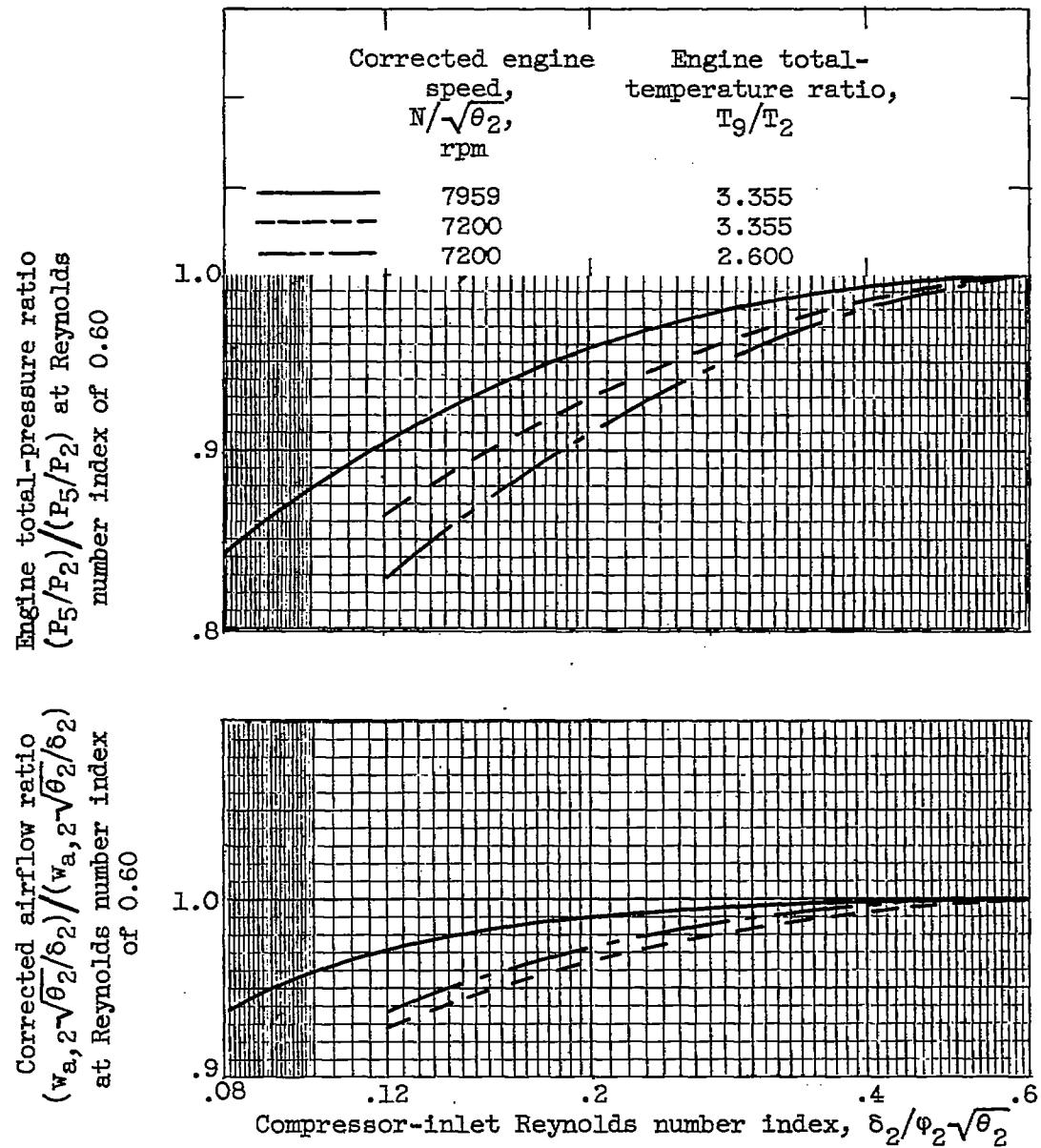


Figure 16. - General trend of engine pumping data with Reynolds number index.

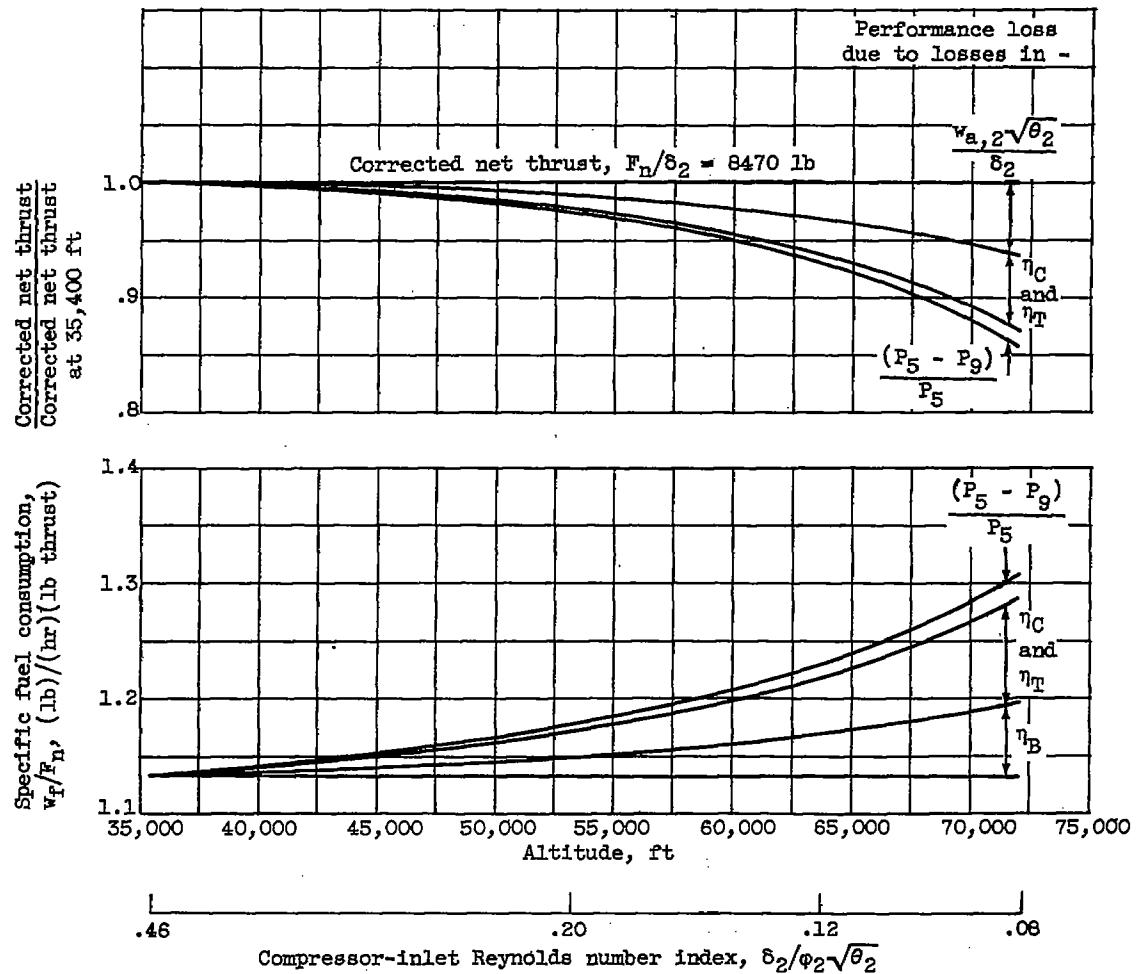


Figure 17. - Effect of individual component performance on over-all engine performance over range of altitudes. Flight Mach number, 0.9; engine speed, 7460 rpm; exhaust-gas total temperature,  $1530^\circ \text{ R}$ .

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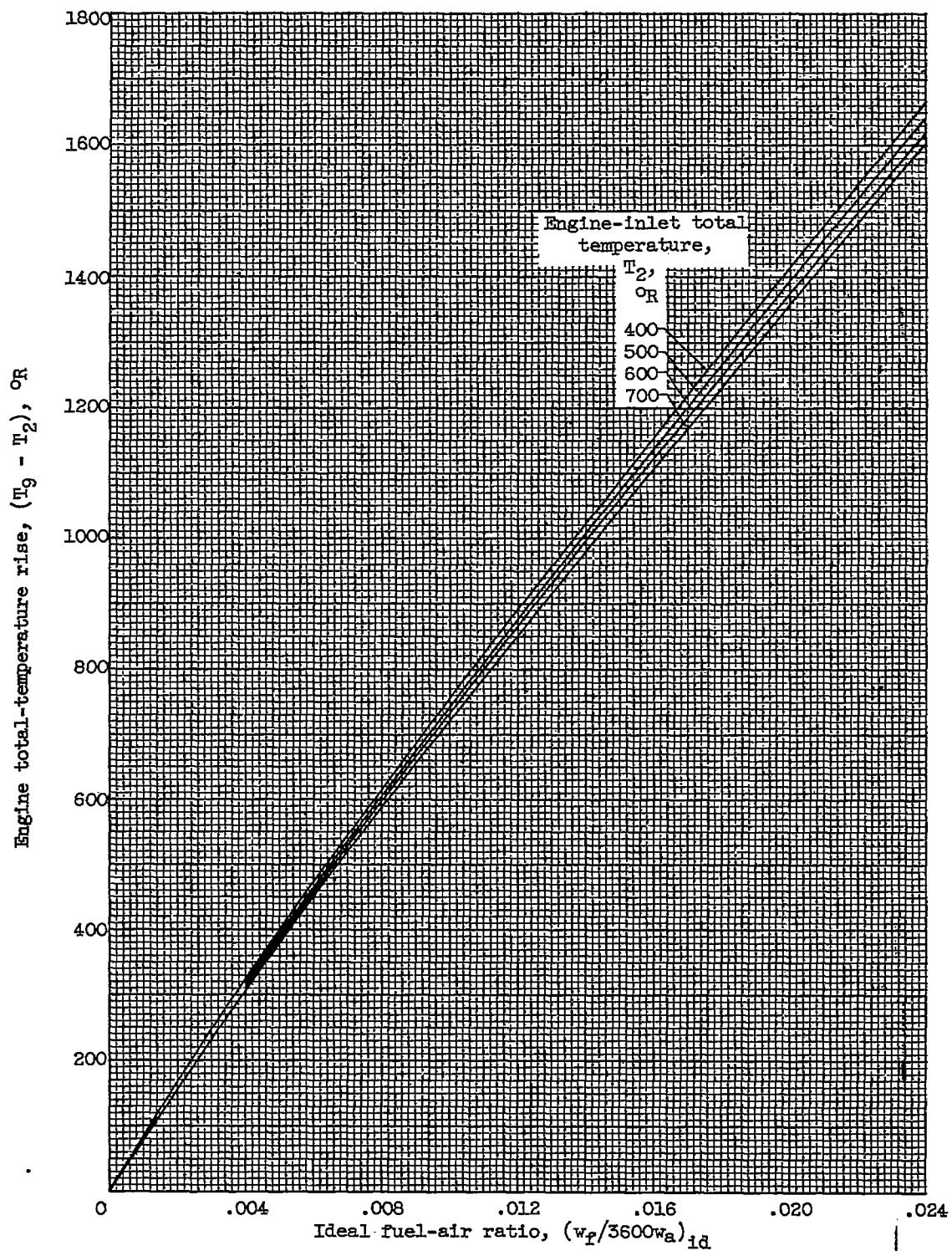


Figure 18. - Ideal fuel-air ratio for fuel used in this investigation.

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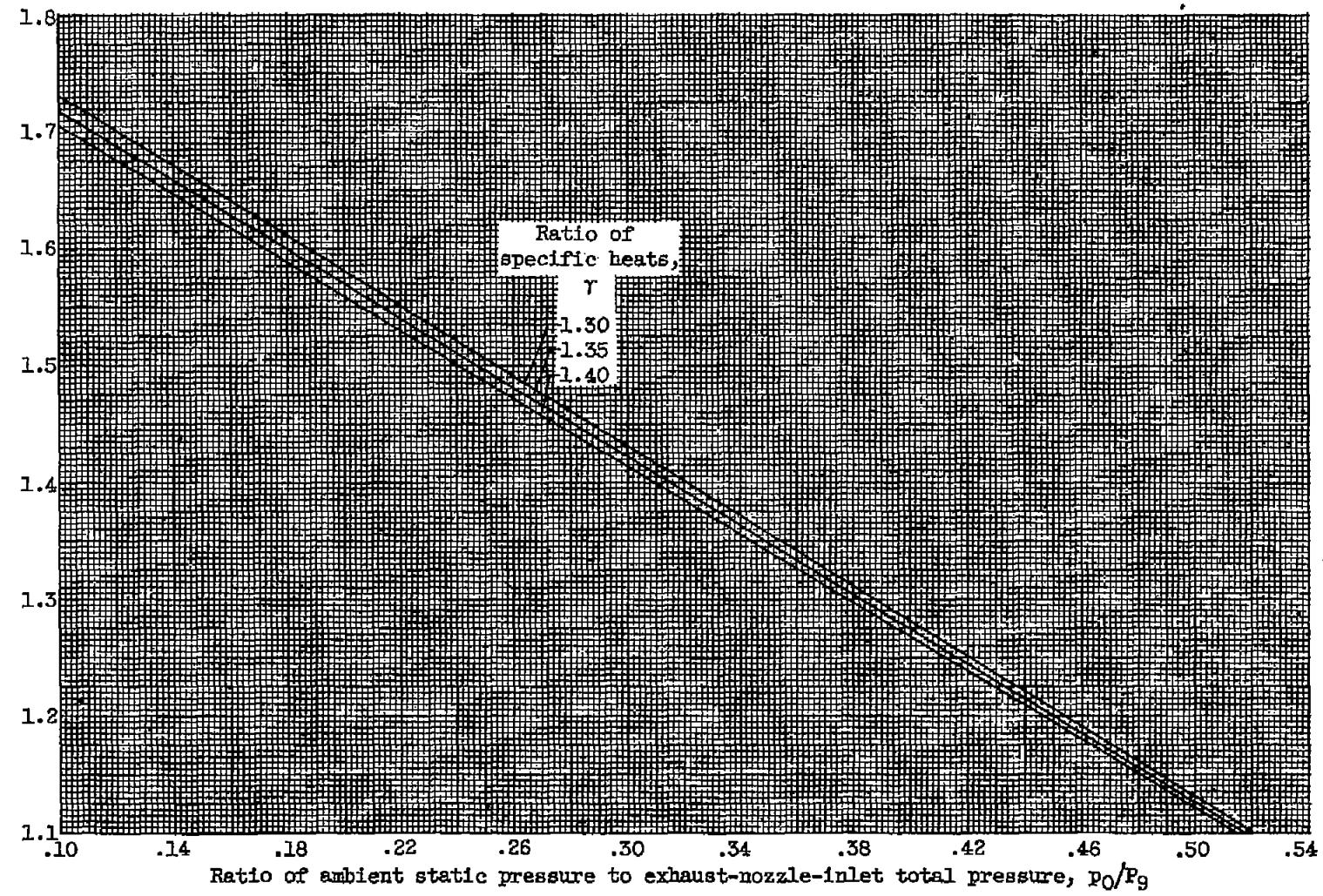


Figure 19. - Effective velocity parameter.

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